AN OGDEN PUBLICATION DEVOTED TO GLASS TECHNOLOGY, ENGINEERING, MATERIALS AND GLASS FACTORY EQUIPMENT AND OPERATION

the glass industry

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1948-1949
R 666.1 v. 29-30

Published by
OGDEN PUBLISHING COMPANY 55 WEST 42ND STREET, NEW YORK 18, N. Y.
JOHN T. OGDEN, Publisher
CYRIL B. DELGADO, Editor and Business Manager
KATHERINE A. HOWE, Editorial Assistant
Midwest Representative: Wm. S. Akin, 308 W. Washington St., Chicago 6, Ill.
Pacific Coast Representative: J. W. Conrow & Co., 1175 Woodbury Rd., Pasadena 6, California

Copyright, 1948, Ogden Publishing Co.

THE GLASS INDUSTRY, Vol. 29, No. 1, January, 1948. Published monthly by Ogden Publishing Company, 55 West 42nd Street, New York 18, N. Y. Subscription $3.00 a year, Canada $3.50. Foreign, $4.00. Single copies 25 cents domestic, 35 cents Canada and foreign. Issues over three months old 50 cents. Entered as second class matter August 10, 1921, at the Post Office at New York, N. Y., under act of March 3, 1879.

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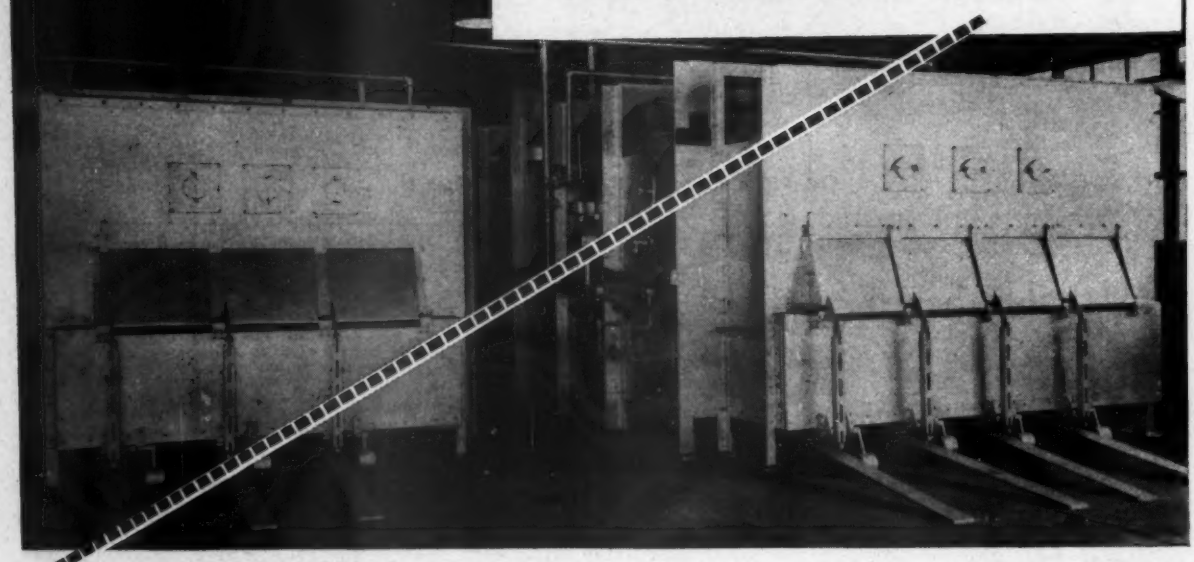

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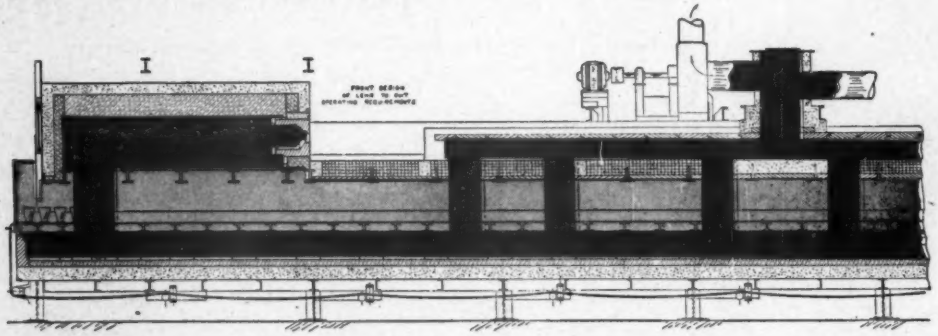

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THE GLASS INDUSTRY

VOLUME 29, NUMBER 1, JANUARY, 1948

CONVECTION CURRENTS IN A GLASS TANK

By IVAN PEYCHÈS, Sc.D.

Director of Research in the Glass Factories of the *Compagnie de Saint-Gobain*

TRANSLATED FROM THE BULLETIN DE L'INSTITUT DU VERRE (PARIS) FOR JUNE, 1947

By LOIS SUTTON and S. R. SCHOLES

PART I

Summary

In the first part, the author rapidly passes over the different methods of detecting convection currents during the action of the furnace as well as after its cessation.

In the second part, the author sets forth at first the principal results which will be considered henceforth as standard: point source, direct current, return current, whorls, etc., drawing conclusions from regimes which are able to establish the position and the driving in of the barriers, etc., in the same operating tank. Thus he explains the divergences among the statements made by preceding experimenters.

In the third part, a simple theory is developed of the dynamics of a glass tank basin. It is a theory which is compared with the experimental results. The article closes with a number of plates reproducing vectors of velocity, the flow lines, and the tank isotherms for the different regimes in the glass furnace.

Introduction

It is customary to say that in a glass tank basin the process of elaboration of the glass is graduated in space rather than in time, as in the old pot furnace. That is to say that, in a given tank, different temperatures prevail simultaneously in more or less remote places. The temperatures are those which are necessary for melting and refining (1450° C), or those necessary for working (1000-1100° C).

These differences in temperature involve differences in density of the melted glass such that, in any particular tank, no regime of static equilibrium can be reached. In the upper part of the tank, hot glass flows constantly toward the cold regions, a movement which is compensated for by a slow reflux of cold glass toward the warm regions. Likewise along the walls, which constitute a natural cause of cooling, the hot glass comes to replace the glass which is cooling and becoming heavy. It is this double movement of longitudinal and transverse convection which assures in a great measure the transference of heat units from the hot zones to the zones without heat, concurrently with radiation or conduction. It is these currents more than diffusion which constitute the principal factor of homogenization. On the other hand, they are responsible in a large measure for the wear of the refractories; for the appearance, sometimes more or less mysterious, of defects in the mixture; and above all, they consume heat at the highest thermal potential.

It is curious to note that these currents, the study of which must be made at the foundation of all construction and all conduct of a furnace, were not discovered until fifty years after glass had been made in a tank basin. For a long time, the superficial movement observed has been attributed to the pulling of the glass. However, upon the cessation of production the swiftness of these currents was not notably modified by the absence of this pulling. The cause had to be found elsewhere.

The first organized study of this question was made by König[1] and dates back to 1927. Formerly, several authors had been studying different sides of the question and their references are found in the main portion of this work. The importance that one actually attaches to these movements is emphasized by the fullness of a bibliography which is certainly incomplete and which is found at the end of this article. The studies, scattered throughout

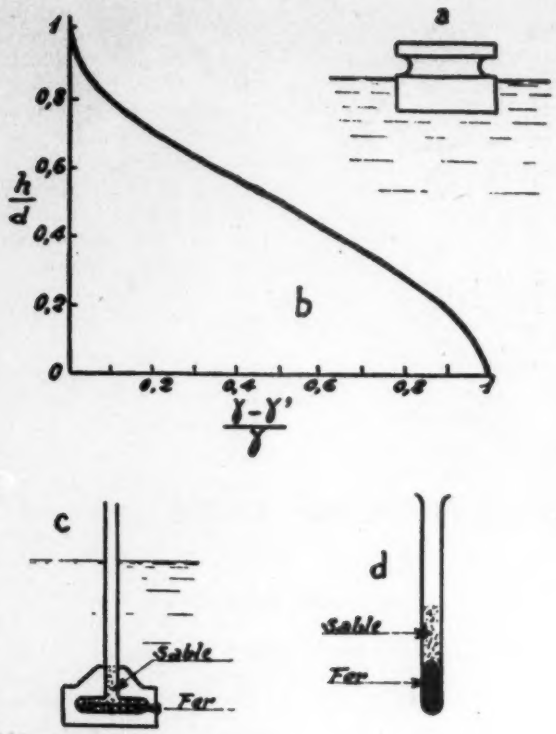

Fig. 1. Floaters.
Sable = Sand
Fer = Iron

a great deal of literature, are often fragmentary, and sometimes, bearing on the case at hand, contradictory; also we have found it interesting to reproduce here the overall view of the problem. We call upon the earlier work for the facts which can be considered as standard or definitely acquired. We have stated several original experiences on actual tanks as well as numerous suggestions inferred in the study of the rough models. Our research has been greatly facilitated by the existence of the electric furnace of the Electroverre-Romont, which, because of its great length opposed to its width, presented in all its purity the phenomenon of longitudinal convection and avoided the complications due to the superficial drifting by the flames.

In Preston's remarkable work[2] on *The Behavior of Glass in Tanks*, he notes that "in the absence of any sort of theory, there will always be doubt as to how far experimental results are of general validity, how far results obtained in one tank are applicable to all tanks; in the absence of some knowledge as to *why* the phenomena are what they are, we cannot be sure they will be the same way in any other tank. . . ." And so, in the present study, we do fear to state several fundamental theories of ours, not supposing that the complexity of the actual phenomena can for an instant be reduced to the simplicity of an equation, but marking a point of departure and specifying a possible direction for study.

PART I

The Currents in the Glass; Methods of Study

Every glass-maker has had occasion to observe the slow deplacement of the scum or the refractory debris on the surface of the bath. This phenomenon is especially important in the long furnaces, such as the furnaces for drawn glass, etc. In such a furnace, we have had occasion to measure surface velocities of 9 meters per hour, in a furnace 4.5 meters wide; the floater used is at a depth of 6 cm.; it transported 6 tons of glass per hour when the pulling of the machine was only 0.9 tons. This elementary experience immediately fixes the order of minimum size of the quantities of glass put in movement by the convection currents. It is generally admitted that for a furnace of glass of good quality, of which the daily production is of the order of a tenth of its capacity, convection puts into play ten times more glass than the pull. In a bridge-wall furnace, the convection is less important; however, it often puts into play double or triple the pull.

The underlying physical reason for these currents will be found further on; for the time being we shall be content to say that they involve the whole mass of the bath, that they have extremely variable velocities and directions, and that their study can lead to serious results only as far as it bears upon a complete observation of these currents. There is no one particular method giving such an entire effect. It is only through the comparison of given results by several methods that one can infer what the currents must be in a constant manner of movement. These are the methods which we will indicate below.

Classification

A preliminary classification of these means of studying permit us to distinguish:

A. The study of the movements "in life": a. floaters (for the surface currents); b. plungers (for the deep currents); c. static slabs or balancers; d. messengers (physical or chemical dosages of a strange element introduced into the composition).

B. The study of the movements post mortem: a. in a solidified bath (by streaks of devitrified or colored glass); b. on the tank walls (by the traces of natural or invoked erosion).

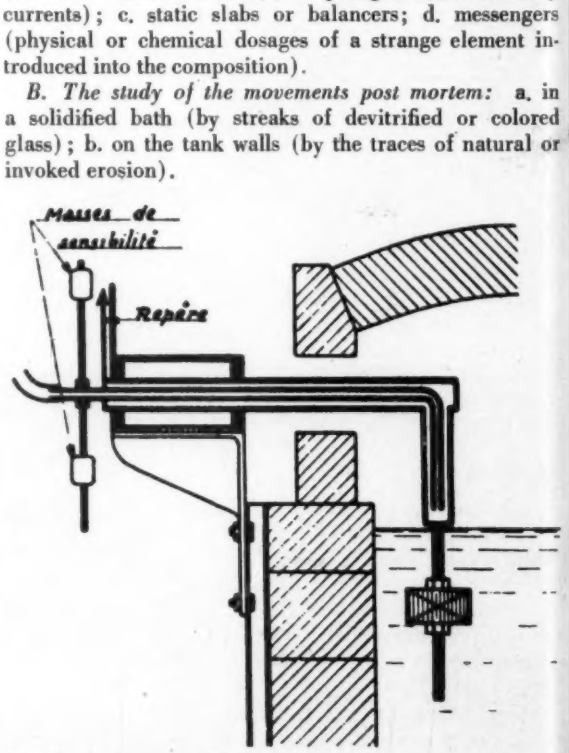

Fig. 2. Oppermann's Balance.
Masses de sensibilité = Counterpoises
Repére = Indicator

Fig. 3. Traces of devitrification.
Paroi Côté Droit = Wall, right-hand side
Sole = Bottom
Angle Arriére du Dog-House = Front Angle of the Dog-House
Axe du Four = Center Line (Axis) of the Furnace

C. The study of models.

A. The study of movements "in life":

a. Floaters. The movement of surface debris has permitted every glass-maker to make occasional observations, but the exact knowledge of that which one measures requires that the floaters respond to certain conditions; it is important above all, in fact, to know at what depth the floater will integrate the action of the currents. For the study of the surface current of only a few centimeters of depth, small bits of refractory or graphite can be used advantageously. (The latter burn with a characteristic flame, permitting the easy marking of the position of the floater on the bath.) The refractory bits will be advantageously fitted by a gorget (Fig. 1a) which will serve as a precise measure of the temperatures by optical pyrometry.

For the study of the superficial currents in a thicker layer, one habitually uses spherical refractory floaters which can have a diameter of 4 to 15 cm. We borrow from Schneekloth and Spielvogel[3] the curve opposite giving the relationship of the immersion height (h) to the diameter (d) of the sphere, as a function of the respective densities of the glass (γ) and of the refractory (γ'). For a refractory body of medium density 1.9 and an ordinary lime glass of density 2.23 at 1450° and 2.30 at 1200°, the sphere is immersed, respectively, to the fractions 0.75 and 0.70 of its diameter (Fig. 1b).

b. Plungers. Used by Novaky[4] following the suggestions of König (loc. cit.) They are masses ballasted to remain immersed to a given depth, whose movement is marked by an emerging antenna. The figures 1c and 1d represent two of Novaky's plungers: the second model detects only the deep current, and thus permits making only differential measurements.

c. Slabs and balancers. This type is the balance of Oppermann[5] (Fig. 2). It is an iron slab carried by a shaft mounted on a horizontal axis; under the influence of these glass currents acting on the slab, the ensemble takes a position of equilibrium and from the angle formed by this position with the vertical, the current speed is deduced. Thanks to this method, Oppermann was able to determine the reversal of the direct current into a return current. In a tank of a depth of 1 meter, the depth of the direct current was about $\frac{1}{3}$. The American school has used balancers of platinum spheres carried by platinum wires. The position of equilibrium taken by the balancer permits the observer to know the current velocity where the sphere is immersed.

d. Messengers. With this first series of methods, we shall associate the method which consists in observing the diffusion of a new composition in an operating tank. Coad-Pryor, Hampton[6], Bowmaker and Cauwood[7] have used such a procedure in estimating in different parts of the basin, the content of barium which was introduced into the composition starting at a given time.

More recently, Bishop[8] introduced cerium hydrate and recognized its presence by the fluorescence in the samples.

Thurmer[9] analyzed glass taken from different depths by a special spoon of controlled closure.

In a similar manner, certain authors have studied the diffusion of alumina.

These processes have the advantage of being useful in an operating tank, without much disturbance. They give an actual representation of the currents. As far as floaters and plungers are concerned, the interpretation of the movement is immediate, at least as long as the vertical component of the current remains weak. The messengers give another sort of response. An interpretation becomes necessary with regard to the path actually followed by the messenger in order to reach the gathering point.

B. The study of movements post mortem:

Investigations undertaken after a tank is put out of service can rest upon either the separation in the chilled mass of glass of trace-markers such as devitrification lines or colored glass, or erosion lines inscribed in the refractory walls.

a. Trace-markers or streaks in the cooling mass. The first method can be weakened by many causes of error

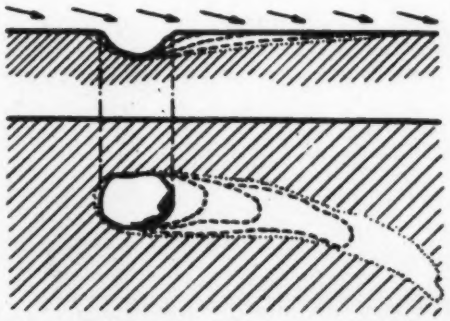

Fig. 4. Erosion Figure.

Fig. 5. Scored Wall.

of fact since during the cooling of the tank and before the viscosity of the glass becomes sufficiently high, a rearrangement of the currents can be produced. To avoid this danger, McCauley[10] operated only on small tanks which he chilled very rapidly after several hours of operation with colored streaks.

Marden[11] applied the same principle to industrial furnaces and has drawn more contingent interpretations from it.

For furnaces of medium dimension, there is the following technique: One or two hours after the introduction of colored materials (generally cobalt oxide in the proportion of a ten-thousandth of the total weight of the glass), all the possible openings of the furnace are freed, the heat-insulating materials removed, and wind is blown upon the furnace walls and the surface of the bath. Within a minimum length of time (one or two hours at the most), the temperature should have fallen below 1000°. The glass is then sufficiently viscous so that there is hardly any further change. As soon as the furnace reaches 800°, a complete thermal insulation is replaced, all the openings are closed and the furnace is left to cool slowly. The mass of glass is then attacked with a pick and studied layer by layer (the method of freezing and quarrying). Lenz[12] has obtained, by this method, many lovely color photographs which are also excellent for interpreting.

The traces of devitrification which appeared in the furnace during the course of cooling, preferably along the surfaces of contact of different laminae, portray equally the general direction of convection currents upon congealing. But this phenomenon can be observed only in the course of slow cooling, and the currents may have been greatly modified.

The opposite figure (Fig. 3) shows a particularly characteristic spiral of which we shall speak later.

b. Erosion tracks. More certain indications, at least in so far as the movements in the neighborhood of the walls are concerned, are given by the erosion lines. The bent tracks are frequently observable in the little-used blocks of the melting and working zones. The corrosion is, in general, much more pronounced in the melting zone, so that one may observe something more than a characteristic vertical gouging, and from which one can hardly draw indications of the general movement.

Later on there are photographs showing such tracks. The tail of the track is directed into the pathway of the movement, and its progression has been made the object of study by Schneekloth and Spielvogel (loc. cit.) We reproduce here the evolution of a cavity subject to erosion (Fig. 4). These traces, outlets of holes, are particularly visible in the opposite figure (Fig. 5). Certain observers [4] and [3] have predetermined their places by piercing obscure holes of 2 cm. in diameter and about 3 cm. in depth within the blocks. They have demonstrated, without a doubt, the existence of a bottom current, returning towards the melting end.

The discussion of these methods brings into play the idea of wall glass or protection glass; the exposition of the present theories [13] to [17] would take us too far for the moment. We shall return to this at the time of the study of transverse movements. We maintain that the study of the movements, deduced from the single observation of raised traces on the walls, can lead, in certain cases, to absolutely inexact interpretations, for these traces are involved only in abnormal masses, cold or viscous, and not in the large movements of the principal glass.

C. The study of models:

Exact knowledge of the distribution of currents in the mass of the bath is difficult to secure because of the hard conditions involved in a direct experience: the least observation of a floater entails long and tedious watching in the immediate neighborhood of a furnace. The opacity of the bath to visible light does not permit one to see anything which happens underneath the surface. Immediately, the idea must come to each one to make, in the laboratory, a model furnace, reproducing to scale the phenomena which must take place in an actual furnace. The discredit sometimes suffered by the models used by technicians, however well-informed, is known only after risky extrapolations or bad use. In order to represent

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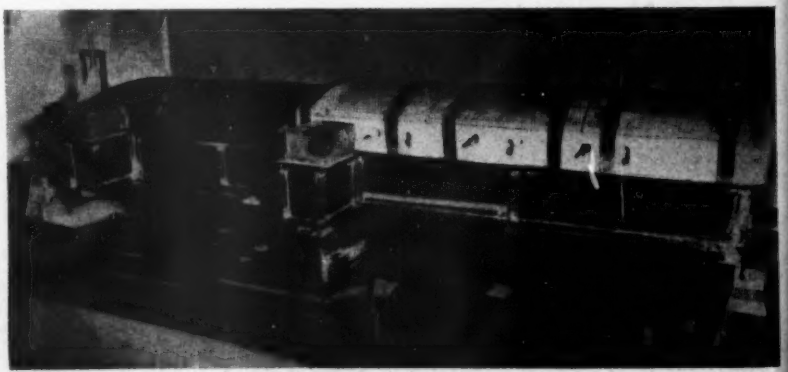


Fig. 6. Model of a Window-Glass Furnace.

THE NINTH URBANA GLASS CONFERENCE

The Urbana Glass Conference of 1947 held on December 4 and 5 in the Mathematics Building of the University of Illinois, was one of the best which the writer ever has attended. Approximately 150 people were registered. Timely subjects were on the program, and without question the speakers, and the data which they presented, were of value to men of every position in the glass industry. Some of the subjects covered, especially the fuels discussion, would have been of great value to other branches of the ceramic industry. Credit is due to Dr. Faye Tooley, Professor of Glass Technology, University of Illinois, for having arranged such an array of speakers and a program of great current interest.

The program was devoted to 1) fuels, 2) raw material problems and 3) handling problems; each session was handled by a different chairman. Messrs. A. L. Simison, A. N. Guthrie, Walter W. Oakley and Harry McDonald served as chairmen and functioned admirably in provoking discussions.

Of major interest to most of the men in attendance were the general reports on the raw material and supply situation, which has plagued production in the glass industry for a number of years. One of the major necessities is fuel, and this particular phase of the conference was discussed effectively by R. S. Arrandale, F. G. Schwalbe, F. T. Rainey and L. L. Swift. The papers presented by these men gave considerable factual data and were thought-provoking to anyone concerned with the manufacture of glass and to other fuel consumers. In many cases, the exact status of a fuel, for example natural gas, was not stated. Likewise, the comparison with other fuels, economically as well as from a standpoint of supply, was not given directly. It was obvious, however, after the presentation of the mass of excellent data and correlation with the general discussions which followed, that some questions could not be answered. Mr. F. T. Rainey, in his presentation on "The Natural Gas Outlook for the Glass Industry," stressed the expansion programs, etc., currently taking place to handle the additional production requirements which have multiplied at a terrific rate in recent years.

To the writer, the discussion of the natural gas situation emphasized the need for keeping our eyes on all three of the major fuels. Glass makers and other industrial users of gas, who originally were considered the "bread and butter" consumers and whose use of gas financed the growth of the natural gas industry by their contracts in early days, gradually are being cut off in favor of the domestic consumer. Domestic consumers who use gas for such essential services as cooking, water heating and space heating, naturally must receive continued service during periods of critical shortages. They, therefore, place a strong demand on the gas producer to keep them supplied. Industry, which is an all-year-round consumer, then must suffer the blows when winter strikes. And on a long-range basis, there is no probability that natural gas will be made available in such quantity as to eliminate this shut-off hazard. Views among geologists and universal economists are not unanimous as to the potential supply of natural gas, but it is safe to say that more could be sold in the next fifty years than can be produced. We, in our generation, may not have to worry about the supply running out, but some of our successors almost certainly will face the problem of shortages. And this applies, according to the speakers, to oil as well as to natural gas. There are good reasons, therefore, to keep coal in mind as a fuel for glass making. The coal industry is awake to the fact that they have an abundant material which can be made more attractive to many users if delivered as gas. Current research on coal gasification suggests that the "black stuff" sooner or later can be

(*Continued on page* 36)

CULLEN WARNER PARMELEE

Cullen Warner Parmelee was born in Brooklyn, New York, on June 27, 1874, and died at Frankfort, Michigan, on August 20, 1947. He received his primary education in the grade schools of Manesquan, Asbury Park and Ocean Grove, New Jersey, and was graduated as valedictorian from the High School at Asbury Park, With a scholarship obtained by competitive examination, he entered Rutgers University and was graduated with the Bachelor of Science degree in 1896, majoring in chemistry. During his undergraduate period he was a member of the University track team and editor of the college weekly and was elected to Phi Beta Kappa in his senior year. In recognition of his professional and scientific attainments he received the degrees of Master of Science in 1926 and Doctor of Science in 1936, both from Rutgers.

He was married on October 3, 1901, to Julia Russel Davis of Asbury Park, New Jersey, a schoolmate during his residence in that vicinity. Three children, Cullen Everett, Eleanor Paulding and Theodore Davis are graduates of the University of Illinois. Another daughter, Mary Payne, died in childhood as the result of an accident.

Following his graduation, he was employed as chemist by the New York and Boston Dyewood Company at Brooklyn, New York, from 1896 to 1901 when he returned to Rutgers as instructor in chemistry. In 1902 he organized the Department of Ceramics at Rutgers University and served as its director for fourteen years. He was made Associate Professor of Applied Chemistry in 1905 and Professor in 1908. He left Rutgers in 1916 to accept the position of Professor of Ceramic Engineering at the University of Illinois. He served as Acting Head of the Department in 1922-3 and was made head in 1923, continuing in that capacity for nineteen years until his retirement in 1942. During most of his twenty-six years of service here he was also consultant for the Illinois State Geological Survey.

On sabbatical leave in 1930-1 he spent a year in Europe where he was engaged in the study of technical and scientific research and developments in England, Germany, Czechoslovakia, France and Italy.

Dr. Parmelee took an active interest in many organizations of the manufacturers of ceramic products. In 1914 he was instrumental in forming the New Jersey Clay Workers Association, comprising practically all of the producers in the state. He served as secretary-treasurer throughout the period that he remained in New Jersey. He served in the same capacity in the Illinois Clay Manufacturers Association for many years. As chairman of the Research Committee of the National Brick Manufacturers Research Foundation, he developed a comprehensive series of investigations in various phases of brick manufacturing. He was District Chief of the Industrial Furnace Section of the United States Fuel Administration in 1918 and a member of the Joint Committee of the American Foundry Men's Association and the Division of Engineering of the National Research Council on Molding Sand Research.

He organized and developed the Glass Conference which has been held for many years at the University and which has received the enthusiastic support of the technologists and research men in the glass industry.

His activity in technical and professional organizations was noteworthy. In the American Ceramic Society he served on a great number of committees and held various offices including that of President of the Society in 1914-15. He was a charter member of the Fellows of the American Ceramic Society and was Dean of Fellows in 1934-5. He directed much of the work of committees on Ceramic Education and Surveys of Ceramic Engineering curricula and was President of the Ceramic Educational Council in 1940-1. In 1942 he was presented with a life membership in the American Ceramic Society with the following citation.

> "Because of his long service in ceramics, his valuable contributions, his leadership in ceramic education at Rutgers University and at the University of Illinois for a period of thirty-nine years, Cullen Warner Parmelee has been elected Life Member of this Society."

This was an honor which had been previously accorded only to a small number of charter members.

Dr. Parmelee was a member of the British Ceramic Society, Der Deutsche Keramische Gesellschaft (in which he was elected to Honorary Membership in 1937), the Society of Glass Technology (England) (elected as Fellow in 1943), the National Research Council (Division of Engineering and Industrial Research) and the Society for the Promotion of Engineering Education. He was for many years a member of the American Chemical Society and the American Society for Testing Materials.

Among professional organizations he was a member of Sigma Xi, Alpha Chi Sigma, Phi Beta Kappa, Keramos, and Phi Kappa Phi. He was also a member of Beta Theta Pi and of Rotary.

Dr. Parmelee was author of three books and of 120 technical and scientific articles including bulletins of the Engineering Experiment Station and of the Illinois State Geological Survey, as well as contributions in journals of European Societies. The broad scope of his interest in research is shown in the variety of subjects included in his publications. Thirty-one articles deal with the properties and tests of raw materials, twenty-two are in the field of glass technology, twenty-seven are on glazes, ten on white wares, twelve on refractories, four on structural clay products and seventeen on miscellaneous subjects in the field of ceramics.

Since his retirement in 1942 he had been engaged in writing a comprehensive book on glazes and had recently completed the manuscript. It is a work which will be a very valuable contribution to ceramic literature.

(*Continued on page* 48)

UNIVERSITY OF DELAWARE INAUGURATES GLASS BLOWING COURSE

By M. G. HAWKINS

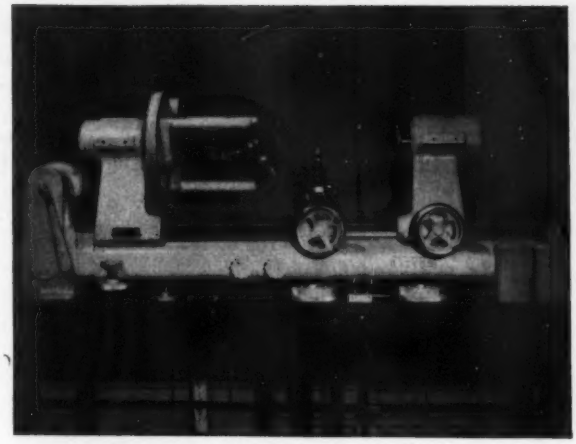
A course in Glass Blowing, inaugurated this year at the University of Delaware, Newark, is an advanced step in vocational training which has been brought about by the need for emergency repair to glass instruments used in scientific research.

At present enrollment will be limited to seniors and post graduates who intend to teach chemistry and related subjects in universities and small schools throughout the state, or those who may be employed in industrial research. It is not a required course, but it is accredited with one hour credit for three hours per week. The prime objective is to provide such professional scientists with a working knowledge of glass blowing to enable the repairing of minor damages to equipment and apparatus which generally requires greater length of time in shipment than in repairing.

Present training facilities limit the class to ten. Included in the equipment are two glass blowing lathes: a Litton 35-inch center, 9-inch radial clearance, with 2⅝-inch spindle bore; and a Standard 48-inch center, 15-inch radial clearance, with 5-inch spindle bore; an American Instrument Company rubber bonded carborundum cut-off wheel; ten Universal glass blowers' lamps (or fires), and a bench for ten students. Shaping and flaring tools of both brass and carbon, and a large annealing oven are included in the equipment. The lathes are equipped with various chucks, including Jacobs', Cushman, and Litton Universal long arm—which takes flasks up to 16-inch diameter. Using propane and oxygen gas mixture of five pounds gas and fifteen pounds oxygen, firing of Pyrex is done at approximately 2700 degrees C.

Simple straight seals from glass tubing ranging in size from 3 to 25 mm O. D., and cane from 3 to 10 mm O. D.; tee seals of various combinations; small bulb inter-seal (or ring seal) for manufacturing small condensers, and Tungsten and platinum seals for electrical contacts will be included in the course. In addition, proper grinding of stopcocks and standard taper joints; spherical joints for use in low vacuum work and proper methods of evacuation of manometric gauges will be taught.

Preparing flask for tubulating on Hartford-Empire model Litton lathe. Flask is supported by Universal chuck.



The Universal chuck used in "necking" or preparing a flask on a Hartford-Empire model Litton lathe.

The class, thought to be the first such course offered at a higher institute of learning, is under the direction of Dr. W. A. Mosher, Head of the Chemistry Department of the University. Frank J. Reese, of the Hercules Powder Company Experiment Station, is the instructor. Mr. Reese will be assisted by G. Edgar Messick and R. E. O'Brien from the Hercules Experiment Station, and by W. R. Wilson from the E. I. du Pont de Nemours & Company, Inc., Experiment Station. Classes are scheduled for Wednesday nights and Saturday mornings. Two instructors will be in charge of each class by alternating with each other and with Mr. Reese.

Mr. Reese, a master glass blower, has thirteen years' experience in glass blowing at the Hercules Powder Company Experiment Station.

OVERMYER MOULD AWARD DINNER

The Overmyer Mould Company honored its 25-year men and their wives with a recent award dinner. Those men receiving gold watches in recognition of their faithful service were Don Strahan, John Bauer, Carl Flatter, George Flanagan, Glen Cartley and C. P. Overmyer.

A centerpiece at the dinner table consisted of a fern- and flower-trimmed latticed arch with a miniature replica of the new plant in glittered plaster beneath. The miniature factory was fashioned on tracks so that it could be separated and its parts rolled back to show a huge cake in the shape of an I.S. mold. This cake, on a revolving platter, opened, its halves revealing cavities in the shape of a glass container down its mould-sides with iced lettering commemorating the occasion.

ENGINEERING THE AIR COMPRESSOR INSTALLATION FOR MAXIMUM EFFICIENCY

PART I — Planning, Selecting and Installing the Compressed Air Plant

In order to obtain the benefits and the advantages of compressed air, planning is essential. To achieve the savings and results expected, care must be exercised in the selection of the equipment, in its installation, and in laying out the distribution system. This article will suggest important questions to consider in planning the compressed air plant.

A compressed air plant (Fig. 1) consists of one or more compressors, each with the necessary driver, control or regulation, intake air filter, after-cooler, air receiver, and interconnecting piping, together with a distribution system to carry the air to points of use.

Objective of Installation. The object of installing a compressed air plant is to provide sufficient quantity of air to the work at sufficient pressure for efficient operation.

Before attempting to determine the amount of compressed air necessary, a thorough study should be made to provide for the use of air power in all applications for which it is suitable. The importance of this study in approaching the problem of installing the compressed air plant is obvious since it will anticipate possible future needs as well as present ones.

The information obtained from the study previously referred to will then become basic in approaching the problem of engineering the compressed air installation in any particular plant. In working out an installation, a series of analyses is recommended. These include: 1) Necessary compressor capacity, 2) Number of compressor units, 3) Location of compressor units, 4) Regulation of compressed air plant and 5) Compressed air distribution system.

1) *Necessary Compressor Capacity.* The proper capacity to install is, of course, a vital question, requiring careful analysis. A study of air-operated devices in a typical plant will show that many of these devices operate almost continuously but there are others which operate infrequently but require a relatively large air supply when in use. It will also be discovered that the actual amount of air used by the individual device will vary considerably in different applications.

The first suggestion is, therefore, that the average air consumption of air-operated tools be ascertained. This may be obtained from manufacturers' literature or may be closely approximated by actual test. Care must be taken not to assume that all air-operated devices consume their maximum under all conditions, as otherwise a false plant size will be developed. Therefore, the Load Factor of the device must be considered.

Relatively few air-powered devices use air continuously. Pneumatic tools of all types operate intermittently and their *net* air consumption is considerably less than their maximum. The ratio of *actual* air consumption to the maximum continuous full load air consumption is known as "Load Factor."

Two items are involved in this term "Load Factor." The first is the "Time Factor" or percentage of total time that the device actually uses air. Obviously, if a number of devices are operated from a compressor plant, and none of them operates all the time, it is reasonable to assume, and experience will bear this out, that the maximum air used in cubic feet per minute is much less than the total which would be required if they were all operating at the same instant at full load.

The second item in the term "Load Factor" will depend on what might be called the "Work Factor," or the per cent of maximum possible work output per minute which is actually done by the device. For example, the air consumption of a grinder with full open throttle varies considerably, depending upon how hard the operator pushes it against the work. The "Work Factor" is, therefore, the ratio of air consumption at the actual conditions of operation to the air consumption when the tool is fully loaded.

"Load Factor" is actually the product of "Time Factor" and "Work Factor."

In one shop studied, the actual air consumed was only 15 per cent of the supposed full-time rated air requirements.

In a large installation the actual load was only 7.6 per cent of the load which might be expected, based on the total tools in operation, plus stock and reserves. If the air supply had been figured correctly on the tools actually in use, the air required would be 15 per cent of the requirements for the tools in use.

In determining Load Factor, care should be taken to eliminate the tools on hand in the store-room or not in use.

It would be wise to discuss these points in detail with the tool manufacturer before finally deciding on the actual air consumption needed.

The above remarks apply to the more steadily operated air tools and appliances. A study of the uses of air power which cause heavy but usually short-time demands will develop added capacity required for these operations. The possibility of storing air in large receivers should be considered, although this can be helpful only to provide for peak demands of very short duration.

Some comment should be made on the practice of adding a percentage to calculated compressor capacity to provide for piping leakage. This has been due largely to the fact that compressed air is so harmless that it is not considered vitally necessary for an air system to be tight. Electrical lines must be carefully insulated—leaks cannot be tolerated. Steam lines are kept tight because of danger and also because steam leaks are objectionable. Refrigerating systems must be tight, both because leakage is expensive and the gas is frequently obnoxious.

There is no more justification for allowing compressed air wastage than there is in buying a compressor with capacity controls, letting it operate continuously at full capacity and discharging the surplus through relief valves to the atmosphere.

Previously, it has been customary to add an arbitrary item of about 10 per cent for leakage. Compare this to

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Based on material contained in "Compressed Air Handbook" just published by Compressed Air and Gas Institute.

Fig. 1. Small two-stage air-cooled compressor complete with driver, filter, pipe-line type after-cooler and receiver.

an acceptable limit in the fuel gas distribution field of less than 1 cubic foot per minute per mile of 3-inch line. Air lines can be made just as tight as other piping systems and can be kept tight. It pays to do so.

Before determining the final compressor capacity, consider carefully that once compressed air is available, its versatility will of itself lead to a magnitude of profitable uses and applications not originally anticipated. Although mechanically it is no problem to increase the size of a compressed air plant since any number of units can discharge into the same system, it is prudent to provide some excess capacity for growth when the plant size is originally considered, including piping system. What this excess capacity for future growth should be will depend largely on individual conditions and total known requirements.

It is less difficult to arrive at the proper capacity needed for plant extension than for a new installation. Local experience, compressor load factors, tool load factors, etc., either known or readily determined, provide a sound basis for decision.

The most frequent indication that more compressor capacity may be needed for an "overloaded" plant is *low air pressure,* which reduces shop production alarmingly. This is discussed in Part II of this article.

Based on a careful log of the pressures throughout the production areas, present compressor operating load factors and peaks in demand (periods of unusually low air pressure), it is possible to determine with reasonable accuracy the additional compressor capacity required to maintain full air pressure at the working positions and thus increase tool effectiveness and production to the maximum. (Note: In all calculations compressed air measurements should be in terms of cubic feet per minute of *actual free air.*)

2) *Number of Compressor Units.* The number of units into which total capacity should be divided is important. Air compressors are sturdy machines but, like all mechanical and electrical equipment, they require maintenance and must occasionally be taken out of service. Compressed air supply during maintenance periods is provided for differently in almost every plant. If the supply of compressed air is vital to continued production, the answer is usually determined by a comparison of the cost of standby capacity with the value of the production loss.

Many plants require a relatively small volume of air continuously, even when the plant is not in production. A small unit of proper size to take care of such requirements over week-ends, holidays, etc., is often desirable and efficient. Examples of such requirements are dry pipe sprinkler systems, oil burners on furnaces which must be kept hot over night or week-end; air supply for tools used by plant maintenance crews over week-ends, etc.

3) *Location of Compressor Units.* The location of a compressed air plant with relation to the points of air use should be given some study. A central plant housing all the compressors involved has advantages in unified operation and care, better supervision, and probably less labor cost. In a central plant, it is probable that no more compressors will be kept operating than are necessary to maintain pressure. The load factor and operating efficiency of each unit will, therefore, tend to be relatively high.

It is possible, however, that a central plant cannot be so located that satisfactory distribution of air and maintenance of pressures may be obtained without excessive piping costs. In such a case, it may be better to divide the compressor plant into two or more installations at or near specific load centers, interconnecting the plant piping so that air may be distributed either way to meet peak load requirements. Of course, the plant should be placed as close as possible to the larger load centers. This reduces piping costs and results in higher pressure at the tools with closer control of the pressure.

Where two or more compressors are installed in various parts of the plant, the equipment should not be placed in some obscure corner with no one to look after it. Such an installation will surely be neglected with costly consequences.

4) *Regulation of Compressed Air Plants.* Since the demand for compressed air usually varies widely from time to time, some form of capacity control is required. Two general methods are available. The first, known as speed and pressure regulation, varies the speed of the compressor according to the demand for air such as is usually done in a steam driven compressor. The second, known as constant speed regulation, operates the compressor at a constant speed and varies the capacity by any one of several types of unloading systems as is usually done in a motor-driven compressor.

For general industrial use, control of pressure closer than a 5 per cent range between full load and no load is unnecessary and should be avoided. Much closer regulation of the pressure can be provided where special conditions require it.

Wherever possible, pressure regulators should be so selected and adjusted that large units will act as base load units and unload only after smaller units have been shut down. Of course, where the requirements have diminished to where one of the smaller units could handle same, the large unit should be shut down. In this way, the overall economy will be improved.

5) *Compressed Air Distribution System.* Any drop in pressure between the compressor and the point of use of the compressed air is irrecoverable loss. The distribution system is, therefore, one of the most important elements of the compressed air plant. In planning it, the

(*Continued on page* 46)

INVENTIONS AND INVENTORS

A Summary of Recently Issued Patents of Interest to the Glass Industry

Glass Compositions

Corning Low Power Factor Glass. Patent No. 2,431,980. This glass is particularly useful as an insulator for conductors carrying radio frequency currents. It is the invention of William H. Armistead, who assigned it to Corning Glass Works.

The desired characteristics of a glass of this kind are a power factor less than .06 per cent, a dielectric constant of at least 7 or 8, a softening temperature not greater than 600°C., and a linear coefficient of thermal expansion in the neighborhood of 128×10^{-7}. This inventor has discovered that all of these desirable characteristics may be had in a glass composition as shown by the following seven examples which are calculated in per cent by weight from their respective batches:

	1	2	3	4	5	6	7
SiO_2	40.0	40.0	40.0	39.5	43.2	42.0	50.0
PbO	50.0	50.0	50.0	49.3	43.9	40.0	30.0
K_2O	6.3	5.6	6.65	6.2	8.6	11.5	12.9
Na_2O	2.7	2.4	2.85	2.0	3.5	5.0	5.6
Li_2O	1.0	2.0	.5	1.0	.8	1.5	1.5
Na_2SiF_6	...	...	...	2.0	...	...	...
Power Factor, per cent	.046	.051	.050	.042	.046	.046	.054
Dielectric Constant	8.2	8.3	8.2	8.2	8.1	8.3	7.68
Temperature Coefficient, P. P. M. per °C.	135	135	135	135	...	...	...
Softening Temperature, °C.	521	506	534	505	...	503	521
Expansion Coefficient $\times 10^7$	103	104	103	102	...	128	122

The following references are of record in the file of this patent: United States Patents: 2,278,868, Deyrup, Apr. 7, 1942; 2,018,816, Taylor, Oct. 29, 1935; and 2,018,817, Taylor, Oct. 29, 1935. Foreign Patents; 233,295, Great Britain, 1925.

Optical Glass. Patent No. 2,431,983. This patent was assigned to Chance Brothers of Smethwich, England, by Raymond E. Bastick and Wilfred M. Hampton. It relates particularly to glass for use in photographic lenses.

This glass has the following essential constituents:

	Per Cent
Silicon dioxide	10-25
Barium oxide	10-35
Lead monoxide	10-20
Boron trioxide	10-25

To this are added substantial quantities of lanthanum and thorium oxides.

Five examples of this glass are given in the following table, it being noted that the batches are preferably melted in platinum crucibles:

Constituents	A, Per Cent	B, Per Cent	C, Per Cent	D, Per Cent	E, Per Cent
SiO_2	15.3	11.3	11.3	15.3	15.3
BaO	34.2	14.7	16.7	19.2	24.2
PbO	10.2	12.7	12.7	12.7	10.2
B_2O_3	15.5	19.5	19.5	15.5	15.5
La_2O_3	10.0	18.0	20.0	20.0	20.0
ThO_2	13.8	13.3	11.8	13.8	13.8
K_2O	1.1	...	1.1	1.1	1.1
ZnO	...	3.1	...	...	...
ZrO_2	...	7.5	5.0	...	...
Al_2O_3	...	...	2.0	...	...
BeO	...	...	...	2.5	...
nd	1.705	1.744	1.721	1.719	1.721
V	47.7	44.7	45.8	46.6	47.3

The following references are of record in the file of this patent: United States Patents: 1,968,854, Pirani et al., Aug. 7, 1934; 2,206,081, Eberlin, July 2, 1940; 2,241,249, Eberlin et al., May 6, 1941; and 2,297,453, Berger et al., Sept. 29, 1942. Foreign Patents: 7,864, Great Britain, 1913, and 688,148, Germany, 1940.

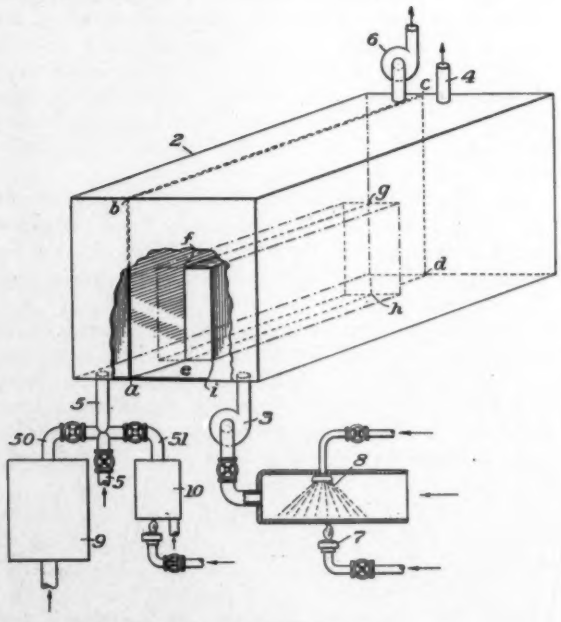

Fig. 1. Method of Drying Tank Block.

Miscellaneous Processes

Depositing Metal on Glass. Patent No. 2,430,520. This patent is the invention of Evelyn C. Marboe of State College, Pa., who assigned it to Glass Science, Incorporated, of New York. This inventor proposes to deposit an adherent film on glass by volatilizing a suitable metallo-organic compound in vacuo and decomposing the vapor of that compound at a hot glass surface.

It has been found that where the hot glass surface is activated by heating under a vacuum to a temperature of about 350 to 450°C., and the vapors of a suitable metallo-organic compound, vaporized or volatilized in vacuo, are brought into contact with such an activated surface, the vapor of the organic compound appears to decompose immediately upon striking the hot glass surface and the metal appears to react therewith to give a metal deposit in the form of an adherent film having superior qualities.

Metallo-organic compounds which may be used include copper formate, copper acetate, and acetylacetonates of copper, nickel and platinum. The coating thus formed may be increased by galvanic metal deposition.

In one example of the practice of this invention, the glass is heated to a temperature of 350-450°C., in a chamber under high vacuum. Copper formate is placed in this chamber and heated to around 170 to 180°C., which

causes volatilization. The vapors striking the hot glass surface apparently undergo simple decomposition which may be indicated by the following equation:

$$Cu(HCOO)_2 \rightarrow 2CO_2 + H_2 + Cu$$

This results in a coated article which may be used as a mirror, having superior qualities. Other examples of methods of carrying out this invention are given in the patent.

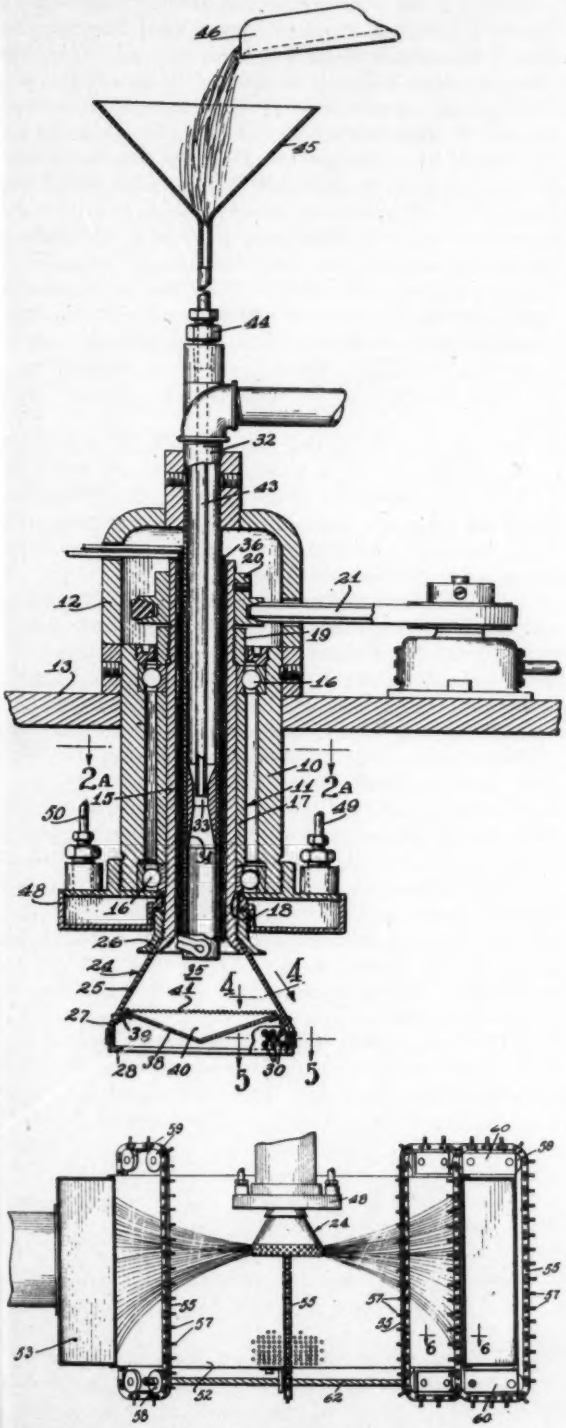

Fig. 2. Owens-Corning Fiberglas Machine.

The following references are of record in the file of this patent: United States Patents: 1,090,456, Darrah, Mar. 17, 1914; 1,675,120, Marden et al., June 26, 1928; 1,816,476, Fink et al., July 28, 1931; and 1,866,729, Spanner, July 12, 1932.

Method of Drying Tank Block. Fig. 1. Patent No. 2,431,201. This patent discloses a method of drying ceramic material but it is particularly adapted to drying large pieces such as tank block. It was invented by Donald W. Ross of Washington, Pa. There are three other related patents or applications: an application Ser. No. 323,925, filed March 14, 1940; Patent No. 2,320,474; and an application filed April 26, 1943, Ser. No. 484,547.

When tank block are removed from the molds in which they are formed, they contain a lot of water and it has been usual to place the block directly into drying chambers. Mr. Ross has found that this practice tends to drive the water to the middle of the ware and to produce a case-hardening of the surface which retards complete drying. He secures better drying by controlling the temperature and humidity so that the moisture is driven toward the surface of the piece.

As shown in Fig. 1, a moist tank block is positioned in a chamber 2 having a partition a-b-c-d. A fan 3 delivers air to the chamber and this air may be heated by a burner 7 and moistened by a water spray 8 as may be desired. On the far side of the chamber, a fan 6 draws air through an inlet duct 5. Ordinarily this air would be drawn from atmosphere but this air may be drawn through a branch 50 and a refrigerating unit 9. The humidity of the entering air may be controlled by a branch 51 leading to a heater 10. By a proper control of air conditions on opposite sides of the partition, the moisture in the block passes from one side to the other and is evaporated from the surface instead of being trapped inside the block.

The following references are of record in the file of this patent: United States Patents: 942,150, Tiemann, Dec. 7, 1909; 1,509,533, Thelen, Sept. 23, 1924; and 1,572,849, Secord, Feb. 9, 1926.

Owens-Corning Fiberglas Machine. Fig. 2. Patent No. 2,431,205. This is a machine for melting glass batch and forming it into fibers by centrifugal force. It is the invention of Games Slayter, who assigned it to Owens-Corning Fiberglas Co.

This apparatus, by a single operation, melts the finely divided glass batch and forms it into fibers of high uniform quality. The fibers are twisted as they are formed, thus producing a yarn ready for winding.

As shown in Fig. 2, the apparatus comprises a tubular sleeve 10 carrying a vertical spindle 11 and an upper bearing frame 12, both of which are mounted on a plate 13. The spindle includes a tube 15 rotatable in bearings 16 positioned by a spacing member 17. This spindle is adapted to be rotated at speeds from 5,000 to 16,000 R.P.M. by a pulley 20 and a belt 21 driven by a suitable motor.

The fiber forming head 24 is mounted on the lower end of the tube 15 and includes a platinum side wall 25, the lower end of which forms a cylindrical wall 27. This wall is provided with a large number of holes 30 through which the molten glass is discharged by centrifugal force. Gas is supplied to the upper end of a pipe 32 and passes

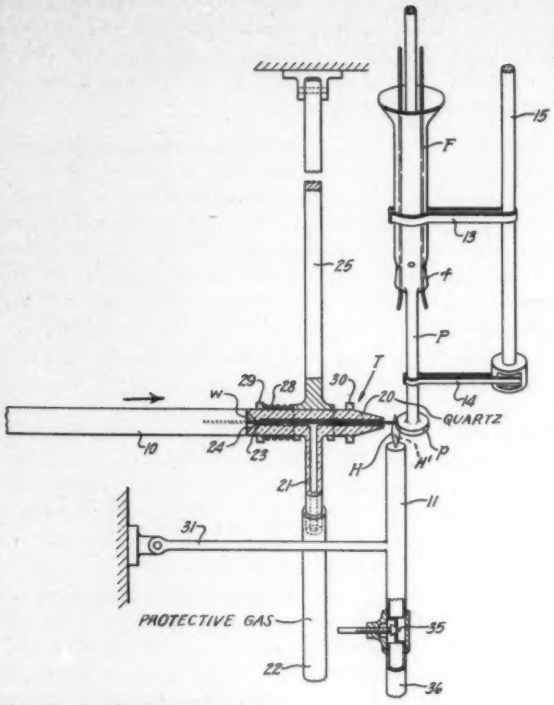

Fig. 3. Sealing Metal to Glass.

to a burner block 34. A water cooled coil 36 keeps the outside bearings cool.

The open lower end of the head 24 is partially closed by a circular plate 38 which forms a shallow well 40 in which the molten glass collects. The batch material is fed to the burner through a pipe 43 which ends at the burner orifice 33. This pipe is vertically adjustable and has at its upper end a funnel 45 to which the batch is delivered by a vibrating feeder 46. The batch is melted as it passes downwardly and it collects in the well 40 formed in the plate 38.

In operation, the molten glass gathered on the wall 25 flows downwardly onto the wall 27 from which it is expelled in very fine streams through the openings 30 onto the inside of a perforated drum 52 shown in the lower part of the figure. A vacuum chamber 53 holds the fibers against the wall of the drum and the mat of fibers is constantly moved by chains 56 having pins 57 which engage the fiber and move it upwardly. In this way a tube of fiber is constantly passing from the drum. The patent gives several methods for treating this tube to prepare it for commercial use.

The following references are of record in the file of this patent: United States Patents: 1,938,982, Smith, Dec. 12, 1933; 2,187,094, Pink, Jan. 16, 1940; 2,192,944, Thomas, Mar. 12, 1940; 2,212,448, Modigliani, Aug. 20, 1940; 2,267,019, Esser, Dec. 23, 1941; and 2,338,473, Pazsiczky, June 4, 1944. Foreign Patents: 272,441, Germany, Apr. 1, 1914; 571,807, Germany, Mar. 6, 1933; 28,521, Great Britain, Dec. 18, 1911; 524,528, Great Britain, Aug. 8, 1940; 50,209, France, Oct. 17, 1939; 780,140, Australia, Jan. 24, 1935; 107,758, Australia, June 20, 1939; and 377,806, Italy, Jan. 9, 1940.

Sealing Metal to Glass. Fig. 3. Patent No. 2,431,208. Joseph E. Stone and Elliot Q. Adams are the inventors of this patent and they assigned it to General Electric Company. The invention relates to the sealing of metal such as tungsten or molybdenum into glass as would be necessary in the manufacture of electric lamps. When this is done by heating the two parts, it often happens that the wire is heavily oxidized or burned, as it is called.

In Fig. 3 the wire-feeding and holding mechanism is shown at 10 which is movable toward and from the glass part p into which the wire w is to be fused. This glass part comprises a button on the end of an arbor P projecting from the stem flare F. This button is heated by a burner 11. The stem is held and moved by clamps 13 and 14 carried by a support 15. The wire w is surrounded by an envelope of protective gas in order to prevent oxidization. This gas may be nitrogen, hydrogen or certain other gases supplied from a tube 20. This tube is preferably made of fused quartz or quartz glass.

For a tungsten wire of 20-mil size, the quartz tube 20 may have 24 mils internal diameter. The device 20 is mounted on the end of an arm 25 by which it may be moved as necessary. The burner 11 is mounted on a swinging arm 31 and the flame may be regulated by a valve 35.

In operation, when the part p has been sufficiently softened, the wire w is advanced and inserted into the soft glass by movement of the part 10. At this time gas from the device 20 surrounds the wire w and protects it from oxidation. Mechanism is described for producing the necessary movements of the parts.

The following references are of record in the file of this patent: United States Patents: 640,419, Schott, Jan. 2, 1900; 1,547,748, Grogan, July 28, 1925; 919,851, Graybill, Apr. 27, 1909; 1,977,638, Knox, Oct. 23, 1934; 1,478,859, Ingold, Dec. 25, 1923; 2,273,437, Dunn, Feb. 17, 1942; 2,215,641, Freeman, Sept. 24, 1940; 2,237,186, Malloy, Apr. 1, 1941; 2,273,439, Freeman, Feb. 17, 1942; and 1,046,724, Beadle, Dec. 10, 1912.

Glass to Metal Seal. Fig. 4. Patent No. 2,431,277. This patent relates particularly to the manufacture of electric discharge tubes where a vacuum-tight seal is to be made between glass and a metal. It is the invention of Otto Pressel and Gerardus A. M. Diepstraten of Carshalton, England, who assigned it to The Hartford National Bank & Trust Company of Hartford, Conn. A corresponding application was filed in Great Britain on February 3, 1944.

It has been usual in making joints of this kind, to provide an intermediate metal component between the glass and the metal to be sealed. This has been fairly success-

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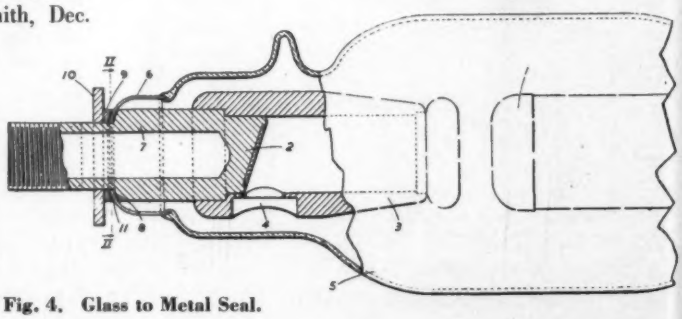


Fig. 4. Glass to Metal Seal.

Research Digest

Functions of Minor Constituents in Commercial Selenium Ruby Batch

Selenium ruby glass is typical of that group of glasses whose manufacture requires extreme skill and long experience on the part of the glassmaker. As a result, batch compositions and the function of each ingredient in the batch is usually a "top secret." Shively and Weyl (*Journal of the American Ceramic Society*, October 1947) have reported the results of an investigation, the purpose of which was to start with the formula of a commercial selenium ruby and to examine the roles which several of the minor, but essential, constituents play in the production of the ruby colored glass. In addition, an attempt was made to describe the function of each constituent in terms of the present picture of the constitution of glass.

The batch formula selected was of the following type:

Silica	50.0	Cryolite	3.0
Sodium carbonate	19.0	Bone ash	1.0
Potassium carbonate	1.5	Selenium	1.0
Borax	4.0	Cadmium sulfide	1.3
Zinc oxide	7.5	Sodium chloride	0.5

In this formula, the sodium chloride is used as a non-oxidizing fining agent.

In the study of the role of ZnO, a series of selenium ruby glasses were melted on a laboratory scale and the zinc oxide was gradually replaced by calcium oxide on a weight per cent basis. This replacement was found to decrease the color intensity to such an extent that the pure calcium end member was practically colorless. In addition, it was found that as the zinc content increased, the amount of selenium retained in the glass increased. Zinc also lowered the melting-temperature.

The role of cryolite (fluorine source) in this particular formula was found to 1) improve meltability of the glass; 2) increase the low temperature mobility of the glass forming units, thus increasing the rate of striking; and 3) increase the number of color centers by lowering the equilibrium temperature of the glass.

The addition of bone ash, especially in combination with additional fluorides, produces crystal nuclei of apatite which in concentrations still insufficient to produce actual opacity provide seeds for precipitation of the colorant (cadmium sulfoselenide).

The presence of traces of copper and nickel compounds in the selenium ruby batch produce crystal nuclei on working out the glass so that during a normal operation the color strikes without requiring a special heat treatment. Some of the raw material used in the manufacture of this type of glass often contain a sufficient concentration of heavy metals to influence the striking properties. This explains the reason why sometimes a change, even to a better grade of material, might lead to difficulties in striking.

In the discussion on the nature of the colorant, it was shown that the glass batch must contain the three elements, cadmium, sulfur and selenium, if the selenium ruby color is to be produced. While sulphur may not be added as such, it nevertheless is present as an impurity in the raw materials or by reduction from sulphates. Since the color is due to a compound whose solubility limit in the glass has to be exceeded, it is not possible to "dilute" a selenium ruby at will.

Alkali sulfoferrite and selenoferrite produce a red-brown color, and their formation in glasses by the means of strong reducing agents, accounts for the deep color of some glasses containing only small amounts of cadmium sulfoselenide.

Oxidation and Reduction of Glasses by Means of Electrolysis

In many glass making processes, such as fining, decolorization and the development of colors, the oxidation and reduction reactions that take place in the melt are the predominate factors in the success of the process. In ordinary chemical reactions at or around room temperature, such reactions are not too difficult to perform due to the many materials that are available for these reactions at glass making temperature. However, such oxidation and reduction reactions become difficult due to the fact that such agents decompose or otherwise become inactive at glass manufacturing temperatures. Oxidizing or reducing agents that will do a job at such temperatures are strictly limited.

This need for "control of the state of oxidation or reduction of glass" led Rindone, Marboe and Weyl (*Journal of the American Ceramic Society*, October 1947) to an investigation on the possibilities of oxidizing or reducing a melt of glass by the means of electrolysis.

The addition or withdrawal of electrons is at present the most direct way to reduce or to oxidize an ion. If, then, a direct current is allowed to pass through an electrolyte, oxidation processes are observed around the anode because of the removal of electrons from the electrolyte. At the cathode, reduction takes place. If an electric current is passed through a soda-lime-silica glass containing the ions Si^{4+}, Ca^{2+}, Na^{+} and O^{2-} as the main-constituents, only one of the ions, namely O^{2-}, can become a source of electrons. At the anode, therefore, oxygen ions are discharged and gaseous oxygen is liberated from the melt. Such a method would allow oxidation or reduction procedures to be carried out in the melt without recourse to chemical materials such as are normally used. An apparatus was therefore devised for the electrolytic oxidation and reduction of molten glass in which a refractory diaphragm was used to separate the anodic and cathodic reaction zones.

Low melting alkali-borate and alkali-phosphate glasses containing a minor addition of colorant were electrolyzed by this procedure using voltages up to 10 volts. Among the various colorants successfully reduced, or both reduced and oxidized, by this method were sulphates, selenites, titania, copper, iron, chromium, manganese, ceria and vanadium. The resulting glass colors were identical with those produced under these conditions. It was in-

(*Continued on page* 44)

HOW NOT TO BUILD A HOUSE— A BOOK REVIEW

"Your Solar House"

The copyright to this work is held by the Libbey-Owens-Ford Glass Company: the author, or authors, is not disclosed: Maron J. Simon claims to be editorial supervisor of a "compilation" with Professor Talbot Hamlin of Columbia University as Architectural Consultant. The apparent extreme division of responsibility makes for great diversity of ideas and opinions, with no serious attempt to analyze the divergencies and inconsistencies. The book is accordingly hard to read, and harder to analyze, intelligently.

Forty-nine architects, one for each State of the Union, and one for the District of Columbia, produce sketches of a house suitable, in their opinion, for their own locality. A brief statement accompanies each one as to why it takes that particular form. The architects were paid a flat fee for the sketch, and were restricted to designs using a lot of glass in the south walls of their designs. The first 25 pages of the book are devoted to general matters relating to "solar" houses, and are the least satisfactory of the book: the rest consists of designs of hypothetical houses. Some of these are interesting, some may be practicable, but the reviewer feels that the fundamental principles are unsound, and that there is going to be a lot of grief if there is a sudden flight to house building of this type.

The original idea seems to have been one of saving fuel: of using the radiant energy of the sun to warm a house in winter. This idea has its limitations. It doesn't work at night, when the house is coldest: it cannot work for even 12 hours a day in winter, since the sun is above the horizon for much less time than this: it cannot work on a dull day, and Pittsburgh has less than 50 per cent of its daylight hours reporting sunshine, averaged over more of the year than ought to require heating. In winter the percentage must be very much lower. Thus the total saving of fuel must be small, even if the pressure of excessive glazing does not cause an additional wastage of heat at night and in dull weather.

Again, a great majority of houses are likely to be so located that the south face cannot be made the glass front with advantage: it may face other buildings, or tall trees, or the city dump. Sometimes you don't want to see out of that particular front, and sometimes, though you may like the view, obstructions prevent access of direct sunlight in winter, when the sun is low.

Finally, even in winter, the radiation of the sun, when low, can be more than sufficient; can, in fact, be exceedingly unpleasant. The book recommends (p. 24) drapes, Venetian blinds, screens and other devices. The Venetian blind is usually the dirtiest piece of furniture in a house, and drapes, unless made of glass fiber, rot out very quickly in bright sunshine. The probability that, nearly all the time, there will be either too much solar radiation or too little, has to be dealt with. The book does not deal with it adequately. It quietly sidesteps the issue and abandons the original thesis, on the first page of Chapter I, by saying that the *chief* purpose is *not* solar heating, but "to unite interiors with the out-of-doors in a spacious, cheer-filled atmosphere." This, of course, assumes that the out-of-doors *is* invariably a cheer-filled atmosphere. As a rule, you go indoors because the outdoors does not meet this specification.

But as soon as you admit that solar heating is not the chief advantage of big windows, you raise the question of whether the glass should face the south. Why look against the light, and see the shady side of everything, if you are looking for a "cheer-filled atmosphere"? The important windows should face the north; the Preston Laboratories were designed on that basis, and after 10 or 12 years I see no reason to suppose it was an incorrect decision. The only windows that give trouble are those that face south, and in particular the ones protected from direct summer radiation give the worst trouble in the winter. Practice seems to agree with theory, that the way *not* to build a house is the way advocated in "Your Solar House."

Quarto, pp. 128. anon.: published by Simon and Schuster, New York: 1947, $3.00.

F. W. Preston

INTERNATIONAL PAPER ACQUIRES O-I PLANT

Announcement has been made by Owens-Illinois Glass Company and International Paper Company of the acquisition by International Paper Company of the corrugated plant and equipment which have been operated by Owens-Illinois in Vernon, Los Angeles County, California.

International Paper Company plans for the continued operation of this property for the production of corrugated products and will supply the full requirements of Owens-Illinois Glass Company's plant in Vernon, in addition to other users of corrugated containers in the Los Angeles area. Personnel which has been employed by Owens-Illinois in the operation of its plant will continue with International.

The purchase by International of the corrugated plant will in no way affect the operation of Owens-Illinois' glass container plant in Vernon.

OKLAHOMA GLASS INDUSTRY

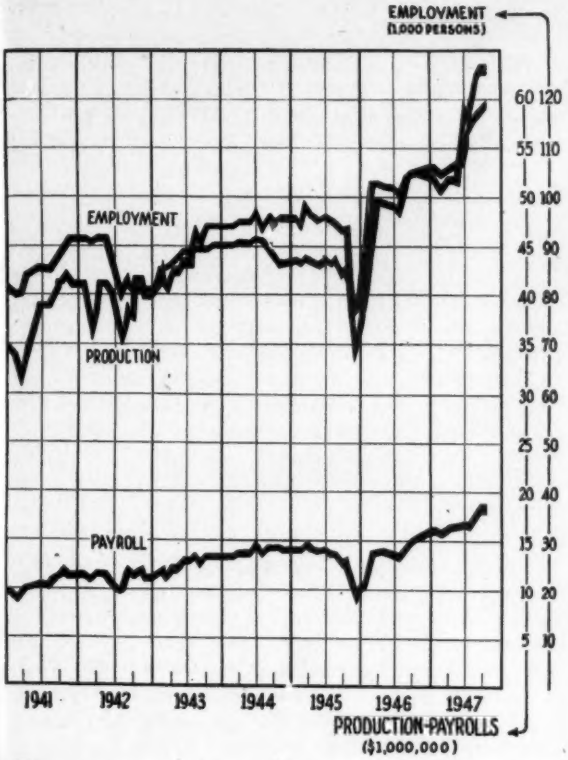
One of twenty-two glass-producing states, Oklahoma is today employing 4,508 workers, an all-time high, in 13 plants which report an average wage of $2,350 per worker, and a total annual payroll of $9,448,000, according to a survey of the state's glass firms completed in mid-November by Thomas W. Finney, Manager of the industrial department of the Tulsa Chamber of Commerce, with the assistance of the state chambers.

New capital expenditures in this growing Oklahoma industry announced in 1947 and projected into the coming year amount to $6,345,000. Public announcements of capital investment in Oklahoma have come from Corning Glass Works, $1,700,000; American Window Glass Company, more than $1,000,000; and Pittsburgh Plate Glass Company, $1,500,000. Almost all the other glass firms operating in the state have major developments under way. The Pennsylvania Glass Sand Corporation of Lewiston, Pa., has purchased facilities in Mill Creek, Oklahoma, and is now established in Oklahoma.

While the state's production of silica has increased from 80,437 tons in 1941 with a value of $128,699 to production of 130,000 tons in 1944 at a value of $235,000, there is much room for expansion in the use of this mineral, it is reported.

CURRENT STATISTICAL POSITION OF GLASS

THE GLASS INDUSTRY'S INDEX



October 1947 activity in the glass industry, according to the Production Index, varied only slightly and remains an approximated $63,500,000, the same as for the previous month. Production during the month of October 1946 was an estimated $55,000,000, or 15 per cent below October this year. The total estimated production at the close of the ten-month period of 1947 is $591,500,000, as compared with $492,500,000 at the close of the same period in 1946.

Employment and payrolls: Employment during the month of October 1947 rose about 1 per cent to an 119,700 persons employed. The previous month's figure was 118,600 persons. Employment during October 1946 was 105,000 persons.

Payrolls for the month of October 1947 remained unchanged from the figure reported for September and is an estimated $18,000,000. Payrolls for October 1946 were $15,500,000, which is about 16 per cent below October 1947. Glass manufacturers have paid out an approximate $166,500,000 in payrolls during the January-October 1947 period. During these same months in 1946, payrolls had reached an estimated total of $128,500,000.

Glass container production for the month of November 1947, based on figures released by the Bureau of Census, fell 12 per cent to the lowest figure reported thus far in 1947, 8,429,525 gross. Production during October 1947 was 9,642,974 gross. During November 1946, production was 9,609,787 gross, which is about 12 per cent over November 1947. Total glass production for the January-November 1947 period is 107,336,245 gross, as compared with 106,405,355 gross produced during the corresponding period in 1946.

Shipments also dropped for November 1947, again to reach the lowest figure of 1947. Shipments were 8,113,222 gross, as compared with 9,165,875 gross shipped during October 1947. This represents a decrease of about 11 per cent. Shipments during November 1946 were 9,573,862 gross, or 15 per cent above shipments for November 1947. Shipments for the first eleven months of 1947 have reached a total of 102,437,010 gross, in comparison with 106,339,511 gross shipped during the same months in 1946.

Stocks on hand at the close of November 1947 are

GLASS CONTAINER PRODUCTION AND INVENTORY

(All figures in gross)

		Production November 1947	*Stocks November 1947*
Foods; Medicinal & Health Supplies; Chemicals, Household, Industrials; Toiletries and Cosmetics	Narrow Neck	5,821,795	4,859,320
	Wide Mouth	2,607,730	3,257,257
Dairy Products		311,639	257,886
Home Canning		.....	*550,855
Beverages, Returnable		867,984	686,716
Beverages, Non-returnable		.....	.....
Beer, Returnable		842,570	205,861
Beer, Non-returnable		202,952	274,408
Liquors		1,329,080	367,257
Wines		343,190	178,477
Packers' Tumblers		140,163	105,926
Total		8,429,525	8,116,577

*This figure represents Fruit Jars only.

GLASS CONTAINER SHIPMENTS

(All figures in gross)

	November 1947
Narrow Neck Containers	
Foods	483,123
Medicinal & Health Supplies	809,806
Chemical, Household & Industrials	383,102
Beverages, Returnable	636,581
Beverages, Non-returnable	.....
Beer, Returnable	765,825
Beer, Non-returnable	209,886
Liquors	1,200,501
Wines	300,378
Toiletries & Cosmetics	371,109
Sub-Total (Narrow)	5,160,311
Wide Mouth Containers	
Foods	1,742,701
Dairy Products	285,319
Home Canning	*13,437
Medicinal & Health Supplies	271,137
Chemical, Household, Industrials	62,332
Toiletries & Cosmetics	78,178
Packers' Tumblers	124,424
Sub-Total (Wide)	2,577,528
Total Domestic	7,737,839
Export Shipments	375,383
Total Shipments	8,113,222

*This figure represents Fruit Jars only.

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8,116,577 gross, as compared with 7,890,375 gross on hand at the close of October 1947 and 3,904,578 gross at the close of November 1946.

Plate glass production, according to the Hughes Statistical Bureau, was 18,776,796 sq. ft. for the month of November 1947. This figure represents a decrease of about 18 per cent from the October figure of 22,988,985 sq. ft. Plate glass production during November 1946 was 20,780,809 sq. ft., or about 9 per cent above November this year. Total production thus far in 1947 is 231,954,043 sq. ft., as compared with 191,595,340 sq. ft. produced during the same period in 1946.

Automatic tumbler production dropped off close to 22 per cent for the month of November 1947 to a total of 4,567,870 dozens. Production during October was 5,833,445 dozens. During November 1946, tumbler production had been reported to be 6,847,675 dozens. Shipments for November 1947 also fell off but only about 2½ per cent. The November figure was 5,061,745 dozens, as compared with 5,185,586 dozens shipped during the previous month. Shipments during November 1946 were 6,526,513 dozens. Stocks on hand at the close of November 1947 were 8,486,575 dozens, as compared with 8,868,549 dozens at the close of October and 5,543,761 at the close of November 1946.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware for the month of November 1947 decreased about 4½ per cent. The figure reported was 4,301,566 dozens, as compared with the October figure of 4,510,709 dozens. Sales during November 1946 were 3,167,937 dozens. Manufacturers' sales for the 12-month period ending November 1947 have reached a total of 41,353,405 dozens, in comparison with 47,847,508 dozens sold during the same period in 1946.

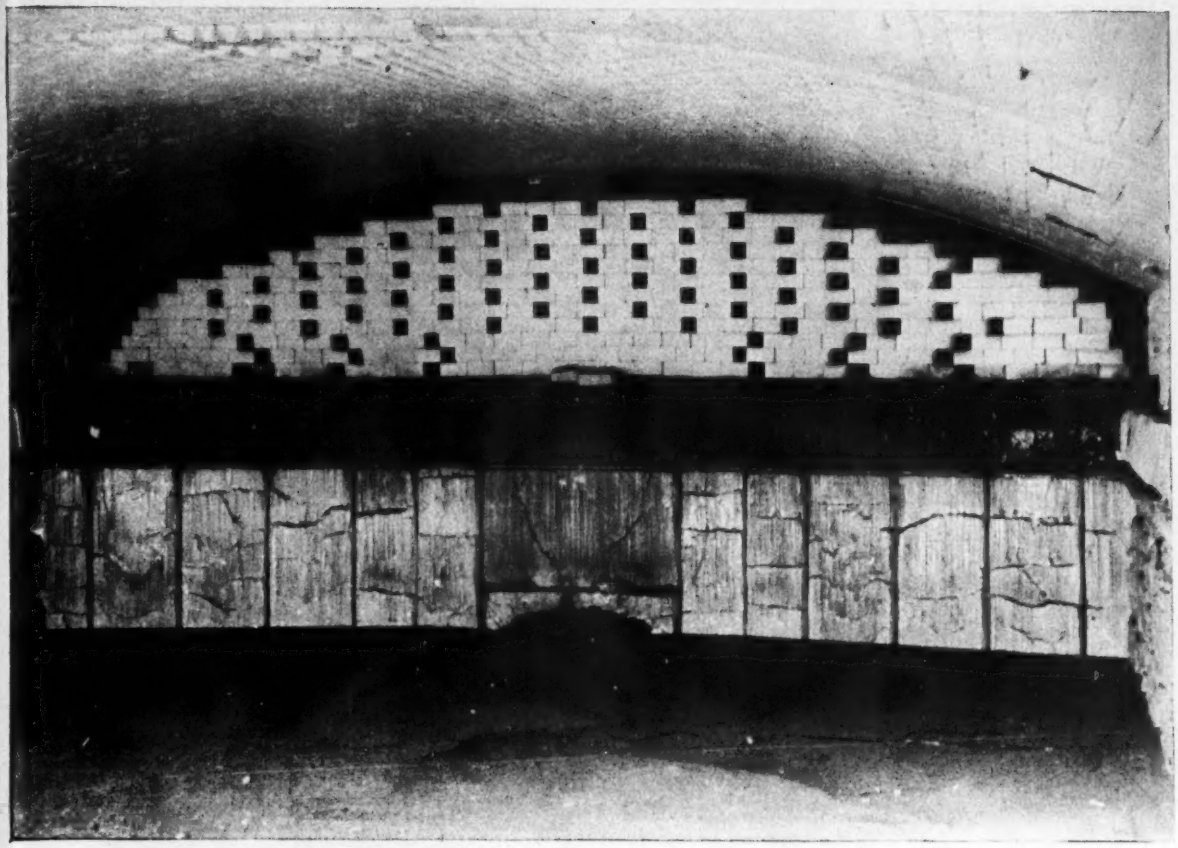
Because of lateness, one company's figures are not included in the figures for automatic tumbler production and table, kitchen and household glassware. However, the totals for this company have been estimated for the compilation of the above figures and if you follow this department regularly, you will note that the figures are adjusted in the following issue when such an instance as this arises.

WYANDOTTE ADDS TO CHEMICALS DEVELOPMENT DEPARTMENT

Marvin S. Carr and Russell A. Kaberg have recently been added to the staff of the Development Department of Wyandotte Chemicals Corporation. Dr. Carr will serve as assistant to the Director of Development, Joseph J. Schaefer. Mr. Kaberg will be a field representative in connection with the various organic chemicals that are being developed by the Wyandotte organization.

Dr. Carr was formerly a research and development engineer of the Electrochemicals Department of E. I. du Pont de Nemours & Company. During the war, he served as supervisor of training.

Prior to joining Wyandotte, Mr. Kaberg was a member of the Development Department of Monsanto's Organic Division, and a rayon chemist at the du Pont Grasselli Chemicals Department Experiment Station.



Good Design, Good Operation Good Refractories, Good Results!

OPERATING DATA

Sq. Ft. Melting Area	585
Total Operating Days	626
Idle Days	190
Total Days (Life)	816
Tons of Glass Melted	86659.1
Tons Glass per Sq. Ft. (ME) for Total Life	148.1
Sq. Ft. per Ton per Day (Operating Days)	4.22
Sq. Ft. per Ton per Day (Total Life)	5.5
Tons Coal Used	31085
Tons of Coal Per Ton of Glass (Total Life)	.359

The photograph above shows the bridgewall and throat of a continuous tank which recently completed a campaign on flint bottle glass.

This well designed and well operated tank, constructed with Corhart Zed sidewalls, Corhart Zac bridgewall and throat and Corhart Standard working end walls, set an all-time production record for its operator.

The operating data at the left gives you the interesting part of the story.

Good refractories such as Corhart Electrocast cannot do the job alone, but they play an important part in the success of any glass tank campaign.

We'll be glad to discuss your refractory problems with you. Corhart Refractories Company, Incorporated, 16th and Lee Streets, Louisville 10, Kentucky.

QUALITY ECONOMY ENDURANCE

CORHART ELECTROCAST REFRACTORIES

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THE NINTH URBANA GLASS CONFERENCE . . .

(*Continued from page* 23)

made available to industry in a form as convenient as natural gas in any desired quantity, and without a shut-off threat in cold weather.

"Raw Materials Problems and Procurement" was handled ably by Messrs. C. L. Rice, J. J. Schaefer, Melvin E. Clark and Axel Ottoson. This particular section of the program also was of special interest; it really represented three different viewpoints on raw material procurement and supply. The over-all picture given by Mr. Rice, of Owens-Illinois Glass Co., showed what the large glass manufacturers are doing or have done. Mr. Clark, of Wyandotte Chemical Corp., as a representative of a manufacturer of soda ash, gave an excellent market survey which his company apparently has used as a guide for future plant expansion. In contrast, Mr. Ottoson, of Imperial Glass Co., representing a producer of quality glassware, gave the keynote to their raw material needs. Based on the presentations and discussions of this subject, it appeared that each individual supplier or manufacturer had problems somewhat unique in themselves, but which, when viewed with the over-all requirements of the glass industry, were of general interest. For example, the manufacturer of soda ash does not desire to expand facilities beyond a point of reasonable expectation of the probable demand. The glass industry represents the largest single consumer of dense soda ash. Soda ash producers, judging from the excellent market statistics presented, therefore, are aware of the needs and potential needs of the glass industry, and apparently have geared up production just enough to take care of the potential requirements, always bearing in mind the need to protect their position. This is a natural precaution, inasmuch as no producer likes to have all of his eggs in one basket. Mr. Rice, who certainly must have had plenty of headaches and is still having them as a result of shortages of materials which his company's operations require in large amounts, felt a little more optimistic about the soda ash situation than did Mr. Clark, who felt that no material improvement can be expected until about the third or fourth quarter of 1948.

"Better Raw Materials" was a rather timely subject for the glass industry as a whole, and was the theme of Mr. Ottoson's paper and of the subsequent discussion by Carl Uhrmann. Both stressed the fact that the glass industry should set standards and try to get raw material producers to supply the type of material required by the industry. Obviously, the raw material requirements, as to both quality and amount, vary widely in the glass industry, as was clearly shown in the two cases presented by Mr. Rice and Mr. Ottoson. In the one case, a large producer of glass requires appreciably higher tonnages of materials of reasonable quality and at minimum cost. In the case of the hand glass producer, however, quality of raw materials is much more important, and cost, although still important, is not nearly so great a factor as in the case of the manufacturer of containers, etc. In spite of these apparently wide differences, there certainly are fields of mutual interest which might be explored to the benefit of both extremes of the industry, and therefore of the glass industry as a whole. For example, the supply and quality of glass sand is of interest to any manufacturer of glass. The hand glass manufacturers, however, use only a small percentage of the total glass sand, and they can afford to pay somewhat higher prices to obtain sands with lower iron contents. In each case, however, it should be possible to adopt standard specifications which would enable each company to secure a sand of the proper quality for its operations at the lowest price. A series of such standard specifications is common practice in various other industries and should prove worthwhile for the glass industry.

Packaging and handling problems were discussed by P. J. Barcus, of Owens-Illinois Glass Co., and Norman L. Cahners, of Materials Handling Laboratories, who showed that considerable thought is given to the handling of glass products. This question of handling merchandise made of glass is of vital importance, as considerable cost is involved in the product. Failure during transit owing to poor handling simply is poor management. Mr. Cahners demonstrated the advantages of the use of standardized pallets in handling materials in the factory and in shipping. The saving in space, time, and labor also was demonstrated.

As the after-dinner speaker, Mr. George Fred Keck, Chicago architect, presented most effectively the potentiality of glass in modern architecture. It was of considerable interest that a man without a glass background was so enthusiastic a salesman for glass products, Solar houses. This has been made possible by the advances in glass technology, and it appears that someone outside the industry is doing a good job of selling our products. Mr. Keck appeared to be sold on glass houses; in fact, he pioneered some leading house designs utilizing large areas of glass. In his examples he showed how extensively glass can be used in home construction, and his figure of increasing the glass consumption from approximately $300.00 per house to $1,500.00 per house represents a large additional market, particularly for plate glass, glass block and the like.

All in all, the entire glass conference appeared to have general value to anyone interested in the varied problems confronting the industry. Executives, technologists and scientists left the meeting with a feeling of having obtained some valuable information and a broad picture of the general problems of the industry. Readers who were unable to attend the conference should watch for the publication of some of the papers. A market analysis, such as the type presented on soda ash, represents a large amount of work and monetary expenditure, and this type of information is of great value currently in view of the uncertainties of these times.

Professor Carruthers, Head of the Department of Ceramic Engineering, Ohio State University, ably handled the toastmastership at the banquet in the absence of Dr. H. H. Blau. In general, all of the people with whom the writer discussed the meeting left with a feeling of satisfaction and of having gained something of real intrinsic value.

• Alfred C. Baechlin, 2033 N. Fortieth Street, Phoenix, Arizona, has been appointed representative for Illinois Testing Laboratories, Inc., Chicago, Illinois. Mr. Baechlin will handle the complete line of Alnor scientific measuring instruments on an exclusive basis in Phoenix.

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Increased melting temperatures demand a super refractory to withstand the withering flames that sweep furnace Upperstructures. MIX 89 is the answer. Expertly blended of India Kyanite and the finest Missouri clays, it defies the ravages of the serverest service:

- **Resists heat shock . . . alkaline vapors . . . destructive temperature variations.**
- **Excellent load bearing characteristics at extreme temperatures.**
- **Very High Pyrometric Cone Equivalent.**

Maximum durability means long-run economy when you use MIX 89 for all Upperstructure flame-swept locations . . . including Port Aprons, Tuckstones, Dog House Mantels, Port Sides and many similar special applications.

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The World's Largest Producers of Glass House Refractories.

FOR SALE

GLASS PLANT, CHICAGO HEIGHTS, ILLINOIS

By order of the United States District Court for the Northern District of Ohio, Western Division, Owens-Illinois Glass Company offers for sale as a unit all real estate, buildings, machinery, production equipment (not including molds), tanks and furnaces (except experimental machinery and furnaces) located at Chicago Heights, Illinois, and which were a part of the assets acquired by Owens-Illinois Glass Company from Kimble Glass Company on July 1, 1946.

In accordance with the order of the Court such property is offered for sale for cash to any purchaser approved by said Court, subject to prior sale, at the fair market value of said property as a glassware manufacturing plant, as determined by an appraisal made by The Lloyd-Thomas Company, which said appraisal has been duly filed with the Clerk of said Court at Toledo, Ohio., where it may be inspected. Additions and improvements made to the property described above since July 1, 1946, and prior to consummation of sale are not included in the appraised value aforesaid but are offered for sale as a part of the unit for an additional consideration equal to the cost thereof to Owens-Illinois Glass Company.

In connection with the sale of the property and additions and improvements thereto above described, Owens-Illinois Glass Company will assign or cause to be assigned to the purchaser thereof for the consideration hereinafter set forth, all its rights in and to the following machinery and equipment leased from Hartford-Empire Company situate on said premises on July 1, 1946, to-wit:

4—4 head I S machines with feeders, revolving tube drives and motors, and variable speed drives and motors

1—5 head I S machine with same

2—36" x 74' lehrs, gas fired with top vertical discharge, motor driven steel plate exhaust fan, and all regular equipment

The consideration to be paid by the purchaser to Owens-Illinois Glass Company for the assignment of its rights in the leased machinery aforesaid shall be cash in such an amount as will reimburse Owens-Illinois Glass Company for a fair proportion of any and all payments made in connection with said leased machinery by Kimble Glass Company or Owens-Illinois Glass Company which may be considered as costs of installation, advance payments for minimum annual royalties, license fees, parts, insurance and taxes.

In the event of such sale, possession will be delivered not later than six months after the consummation of such sale to a purchaser approved by the said Court.

Address all inquiries to

Owens-Illinois Glass Company
Attention: F. G. Morfoot
P. O. Box 1035, Toledo 1, Ohio

AMERICAN WINDOW GLASS ANNOUNCES BOARD CHANGES

The American Window Glass Company has announced the election of J. Patrick Lannan of Chicago as Director of the Board, succeeding A. E. Braun, who retired for reasons of health. Messrs. H. Eastman Hackney and Daniel Maggin were re-elected Directors.

Richard S. Berry was elected Treasurer to succeed R. M. McClurg, who has been appointed Consultant and Advisor to the President.

James L. Williams was elected to the newly created office of Controller and Daniel Maggin was elected a Vice President, succeeding A. E. Braun, retired.

J. P. Lannan

Other officers re-elected were A. S. Crandon, President; R. J. Whalen, Vice President and Secretary; and W. J. Walls, Assistant Secretary and Assistant Treasurer.

Mr. Lannan is a partner of Kneeland & Company, and a Director of American Silica Sand Company, Ohio Gas Company, Federal Electric Company, Lake Building Materials Company, Plastic Lining Corporation and Missouri Pacific Railroad. He is also closely associated with the Jessop Steel Company in an advisory capacity. Mr. Lannan is at present in Europe where he is making a study of economic conditions. In 1945 he made a similar study for the Chicago Journal of Commerce.

ANCHOR HOCKING MOVES CLOSURE DIVISION

The Anchor Hocking Glass Corporation has moved its Pacific Coast Closure Division into a new factory at 8653 Atlantic Boulevard, South Gate, California.

The new, modern one-floor plan South Gate factory at present has 36,900 sq. ft. of floor area available for manufacturing operations. Included is 3000 sq. ft. of floor area devoted to plant offices. The increased manufacturing area makes possible a twenty-five per cent increase in closure output.

GLASFLOSS CORPORATION SUED FOR PATENT INFRINGEMENT

Modigliani Glass Fibers, Inc., has filed suit for an injunction against infringement and an accounting against The Glasfloss Corporation, subsidiary of Tilo Roofing Company, under the plaintiff's glass fiber patent.

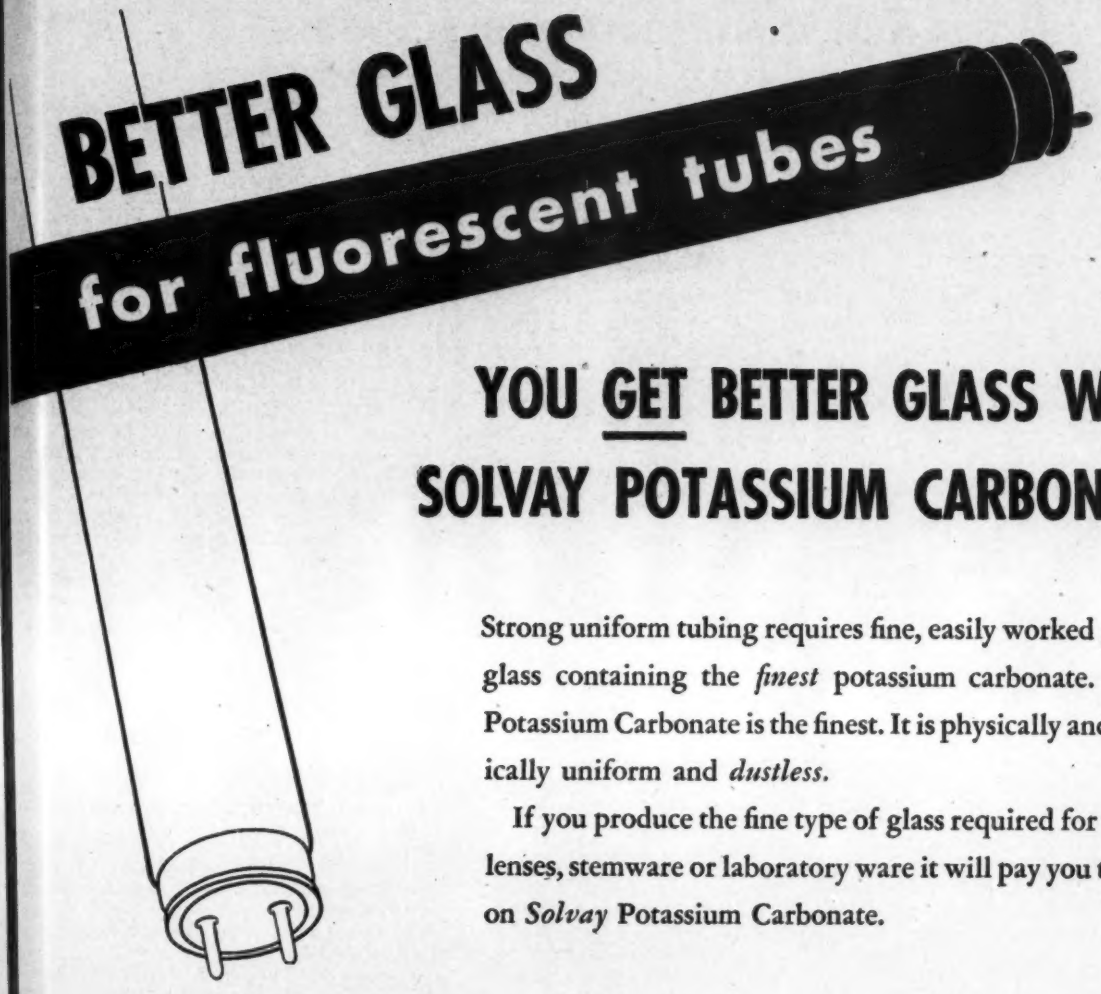
Suit was filed in the Eastern District Court, United States District Court, on December 4, 1947.

ALBERT W. HAPPEL OF LYNCH DIES

Albert W. Happel, former Assistant Chief Engineer and recently appointed research engineer of the Lynch Corporation, died recently after a heart attack.

Mr. Happel was well known in the glass industry and has contributed a number of inventions on glass forming machines.

BETTER GLASS
for fluorescent tubes



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Strong uniform tubing requires fine, easily worked glass—glass containing the *finest* potassium carbonate. Solvay Potassium Carbonate is the finest. It is physically and chemically uniform and *dustless.*

If you produce the fine type of glass required for tubing, lenses, stemware or laboratory ware it will pay you to insist on *Solvay* Potassium Carbonate.

FOR HIGH GRADE GLASS *Buy High Grade*

POTASSIUM CARBONATE

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EXCLUSIVE!
Dustless Calcined Potassium Carbonate
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NEW EQUIPMENT AND SUPPLIES

MILNER UNIT BATCH SYSTEM

The Milner Company, Muncie, Indiana, has developed the Milner unit batch system which is a patented system for efficient application of proven engineering principles. The system is composed of car unloading equipment, a compact circular welded steel storage silo divided into compartments, batching scales, conveyors, batch mixer and batch delivery system.

One of the features of this pre-engineered plant is the silo arrangement which actually consists of an inner silo with a surrounding outer shell. Since the average glass batch contains approximately 50% sand, the inner silo is used for that material and will hold about 25 carloads. The space between the inner and outer shell is divided into compartments for other ingredients such as soda ash, lime, factory cullet, foreign cullet, feldspar, etc., and will hold about 25 carloads of the combined materials. The variable arrangement of these compartments provides flexibility to meet individual plant conditions. The silo is constructed in such a manner that the load is transmitted over the entire occupied area eliminating extensive and costly sub-structures.

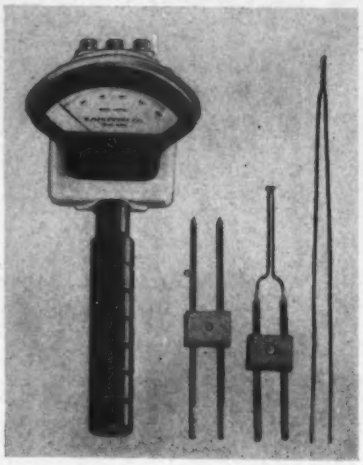
A powered rotating distributing conveyor is located on top of the silo and is remotely controlled from grade level. A key system is provided to prevent errors in unloading the raw materials.

The vibratory feeders, weigh hoppers and scales are constructed inside the silo structure and are arranged like spokes in a wheel, with the feeders terminating at two individual scale units. One unit has coarse graduations for sand, cullet, etc., where extreme accuracy is relatively less important; the second unit has fine graduations for the smaller components where very accurate weighing is essential.

Standard equipment consists of a manually operated control bench with push button operation by one operator who also prepares and charges the decolorizer agent. This unit is always provided although semi- and full automatic devices are available if found desirable from an operating viewpoint. The manual control, therefore, is always ready to function in case of failure of automatic control devices.

A collector belt conveyor then receives the batch from the two scale hoppers and delivers it to the mixer which is housed in a small addition to the silo. The mixed batch may be transported to the furnace by tramrail or other accepted means.

Another feature of the new system is the complete dust control unit which is built into this plant to provide control at all points where this hazard might exist. All conveying equipment is housed in dust sealed casings provided with clean-cut openings, and all units are connected by a duct system to the dust collecting equipment.



PYROMETER THERMOCOUPLE SERIES

K. H. Huppert Company, 6830 Cottage Grove Avenue, Chicago 37, Illinois, has announced its recently completed series of pyrometer thermocouples. The latest thermocouple is a closed-end type with a silver tip suitable for highly accurate temperature readings on hot metal, rubber or plastic surfaces.

Providing temperature readings within 2% of absolute accuracy, this line of portable pyrometers has many features. The instrument weighs only 1¾ pounds and has a cast aluminum body, with the scale set at an easily read angle which prevents distortion and side reflections. A firm, comfortable grip is afforded by the sturdy six-inch handle that screws solidly into the front of the instrument body. Standard duo-range scales in either Fahrenheit or Centigrade are carried, with special scales made to order.

REFRACTORY COATING

The Whitman Company, 1407 Esperanza Street, Los Angeles 23, California, is manufacturing "Vitroseal," an insulative coating for preventing spalling action, resisting heat penetration and decreasing carbon, slag and clinker adherence in fire boxes, furnaces and crucibles.

Vitroseal refractory coating forms a semi-glazed protective monolithic wall of from 8.5 to 9 hardness (Diamond is 10-Mohs scale) between fire and the fire brick that is impervious to heats up to 3390° F., and it withstands the destructive effects of flame impingement and abrasion.

Vitroseal's glazed coating speeds heat-up time due to reflection and decreases heat loss through joints thereby saving considerable fuel costs, in addition to cutting excessive rebricking labor costs. The refractory coating is applied by either brush or spray and is shipped to the user in powder form and water is added before application.

MULTI-FORM GRADER

The Exolon Company, 965 Niagara Street, Tonawanda, New York, is producing its multi-form grader which will handle any material in dry granular form between 4 and 250 mesh. Materials that have been accurately graded on this equipment include silica sand, nepheline-syenite, feldspar, clays, bauxite, chemicals, garnet, etc.

The materials are fed from the hopper to the top screen. The over-size material is carried off through chutes at the end of each screen, the "unders" passing through the screen into a pan and then through a wide chute onto the next finer screen. A uniformly even flow of material is assured and every square inch of screen surface is utilized.

Since all of the screens are vibrated as a unit, the screening action of each sieve is identical with the others. The standard model has four decks, each with a screening surface 34" x 27½", giving a total screening area of 26 sq. ft.

CATALOGUES RECEIVED

Leeds & Northrup Company, 4934 Stenton Avenue, Philadelphia 44, Pa., has issued a new 16-page catalogue which serves as a handy guide to all their round-chart Micromax instruments.

Called "Micromax Model R—Indicating Recorders and Controllers," the publication is not limited to those instruments used to measure any one quantity, using any one primary element, but presents for the first time all Micromax Model R's, regardless of whether they are supplied to measure temperature, through the use of thermocouples, Rayotubes or Thermohms, or other quantities such as frequency, gas analysis, electrolytic conductivity and pH.

Included are complete specifications in easy-to-use tabular form for automatic indicating recorders, and indicating and recording controllers. Suggested chart numbers are also listed for the more commonly used ranges, together with other accessories and supplies.

The Bristol Company, Waterbury 91, Conn., has published a new bulletin, No. P1235, covering thermocouples, protection tubes and pyrometer accessories. The bulletin gives detailed drawings, complete information and prices covering the accessories for pyrometers, which the company carries in stock for immediate shipment.

In addition, the bulletin contains a chart and valuable engineering data on selecting the right thermocouple and protection tube.

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CONVECTION CURRENTS IN A GLASS TANK . . .

(*Continued from page* 22)

reality, the model must be subject to certain conditions of similitude, and it is not enough at all simply to divide by *n* in order to have the problem resolved. The likeness of a normal furnace can become a sort of crude reservoir in order to obey the laws of similitude of such a particular phenomenon for study.

Schild[18] has made a summary study of the conditions of dynamic similitude, which has been criticized by Preston (loc. cit.). J. Runge[19] has also studied these conditions. It seems that in no case has it been possible to establish a tank model responding exactly to the required conditions of similitude. The dynamic state of the liquid depends not only on the specific properties of the liquid: specific mass, viscosity, diffusivity, etc., . . ., at different temperatures, but also the external conditions such as: penetration of radiation insuring the flow of heat, losses by the tank walls, etc.

The model can thus only *suggest* a certain state of movement, but in no case would it *demonstrate* its real existence. The model will attract attention upon such a point or such a critical zone: whirlpools, neutral line, etc., whose actual existence must always be verified in the furnace by the aid of floaters or adequate plungers.

Experience has shown that a model of 1/10, walled by plate glass 6 mm. thick and containing glycerine between 70° and 20° C, represented well enough the history of an actual tank between the fusion temperature and the working temperature.

One may also use polystyrol, butyl metacrylate, etc., . . ., but in no case water, whose fluidity flattens all the circuits and corrupts the representation.

In many cases, one finds that the vertical gradient of temperature is not suitable on account of the longitudinal gradient: the bath cools too much in depth. It is expedient, then, to insulate the bottom better, and even to bring heat there artificially.

The opposite figure (Fig. 6) shows the model of a window glass furnace. Underneath the tank the presence of corrective heating plates can be noted.

For the study of particular effects due to direct electric heating in the mass of glass, one takes silicate of soda, protected from the air by a very thin film of vaseline.

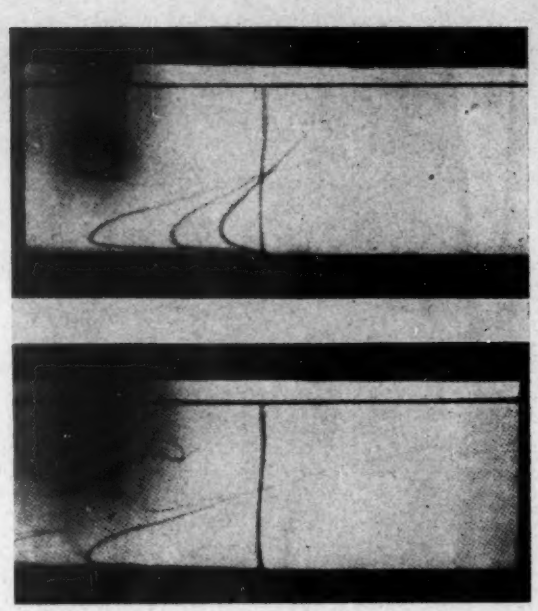

Fig. 8. Detection of currents in a model tank.

The "laws" by which we are directed in the last part have been recast by systematic study of a model using glycerine.

The glycerine bath is contained in a long tank of graduated glass whose walls can receive different insulators to modify the losses. The melting chamber is heated by immersed electrical resistances, or by surface radiation, or finally by gusts of warm air, according to the type of heating to be studied (Fig. 7).

The study of currents has been made, thanks to a particularly convenient method which we have put to work and which we describe below.

We introduce vertically into the bath a slender pipette containing glycerine slightly alkalized and colored by phenolphthalein. We thus deposit a colored vertical filament whose deformations we follow minute by minute; these deformations are traced on the walls or photographed and reproduce the envelopes of the vector speeds for the considered time. When the filament is diluted, the tint due to the phenolphthalein completely disappears in the slightly acid medium. The above photograph (Fig. 8) represents the evolution of the colored filament at different times.

A strioscopic study can also lead to interesting results. In the course of the preceding studies, one can become convinced that no one of the described processes can, by itself, furnish a rigorous representation of the state of movement in a glass tank. This it is, moreover, which explains the contradictions to which authors who have wished to draw too much from a single class of observations are led. Furthermore, the

(*Continued on page* 44)

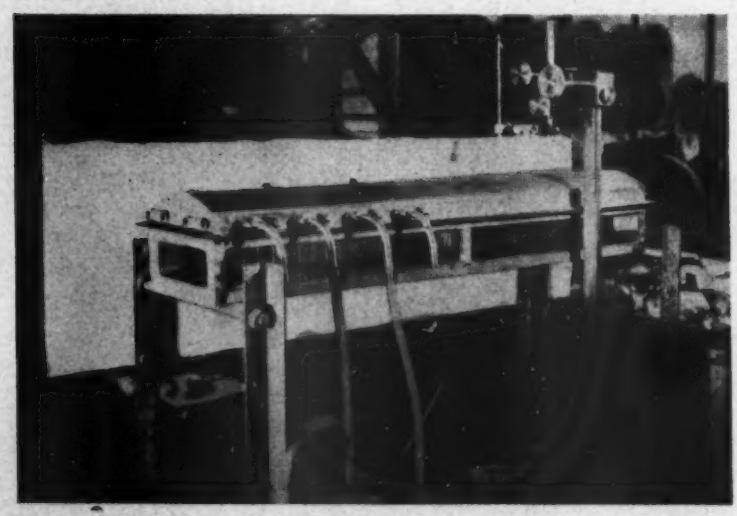

Fig. 7. Tank for Experimental Study.

FORTER-TEICHMANN

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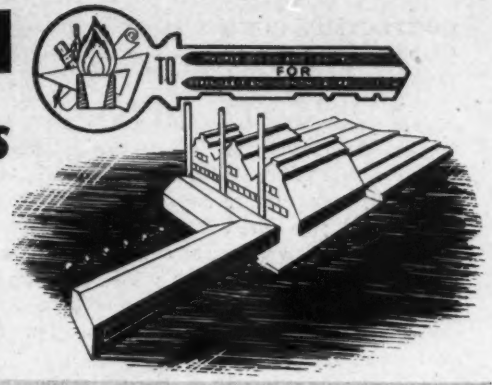

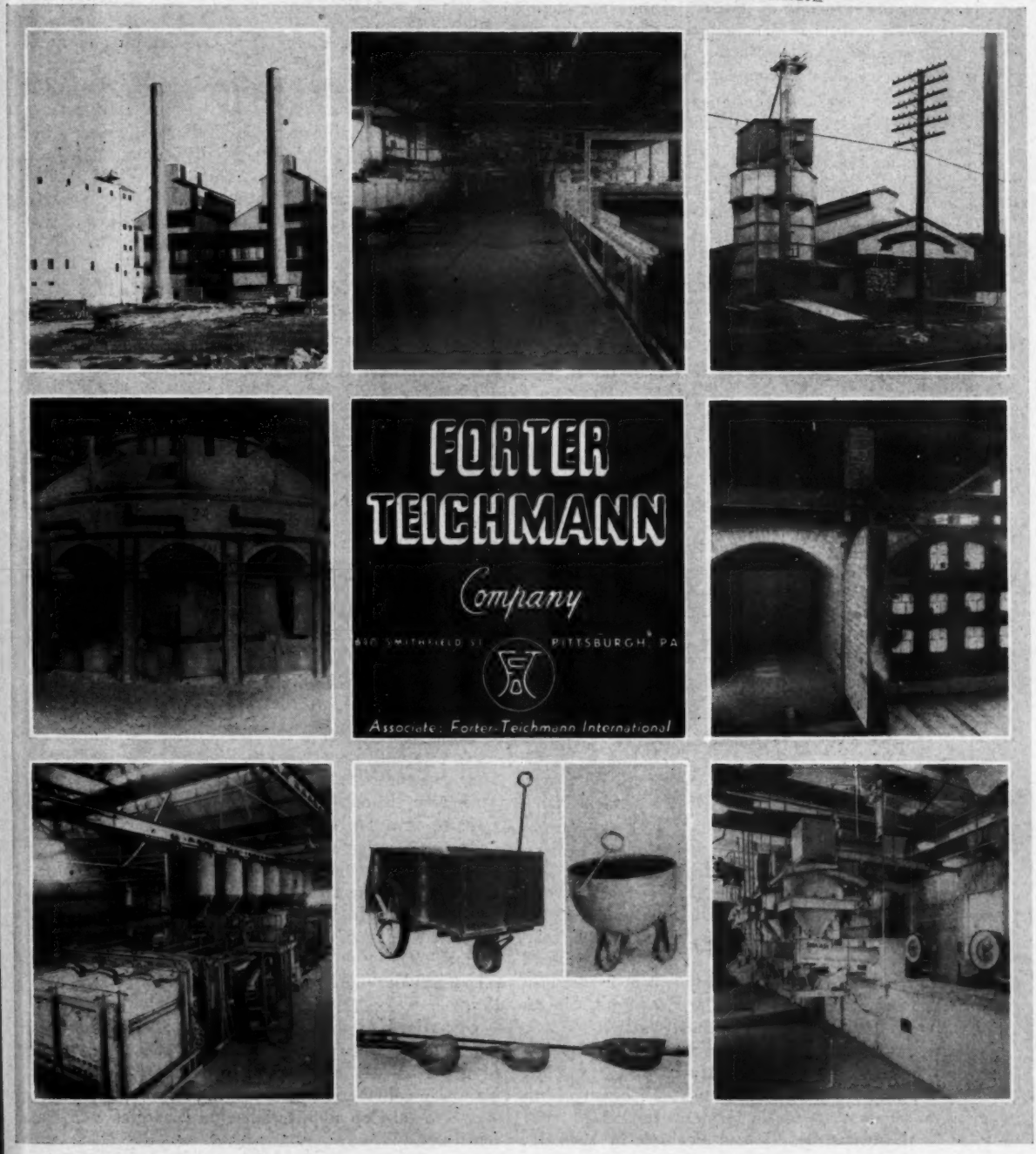

CONVECTION CURRENTS IN A GLASS TANK . . .

(*Continued from page* 42)

regime which becomes established in a given tank can notably differ from that which will establish itself in a tank of slightly different dimensions, or heated on another temperature curve, or differently ventilated, or insulated. We have even been able to declare that, in furnaces obviously identical and conducted in a similar manner, the regimes of the currents could, during a whole campaign, remain different because a chance incident at the start had favored the formation of such and such a way of circulation.

However, the ensemble of pursued studies by different authors discloses certain general principles, certain current paths common to all furnaces.

We shall now state the general results.

(*To be continued*)

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RESEARCH DIGEST . . .

(*Continued from page* 31)

teresting to note that this investigation indicated that commercial grades of soda ash and borax contain a sufficient amount of sulfate as an impurity so that glasses made from these raw materials show the characteristic blue or amber sulfur color on cathodic reduction.

This "electrolysis" procedure was also found to be useful for lowering the gas content of glasses (molten) and for increasing the infrared transmission of a glass by removal of water from the glass.

PENNSALT APPOINTMENTS

The appointment of William J. Hennessy as Pittsburgh District Sales Manager for the Special Chemicals Division of Pennsylvania Salt Manufacturing Company has been announced.

A graduate chemist from St. Joseph's College, Mr. Hennessy joined the company in 1935. After several years' experience in manufacturing operations at the Greenwich plant in Philadelphia, he joined the Special Chemicals Division as a salesman in 1939. As head of the Pittsburgh District, Mr. Hennessy will supervise special chemicals sales operations in the Pittsburgh, Cincinnati, Cleveland, Buffalo and Altoona territories.

The announcement has also been made of the appointment of Vance N. Wilson as Safety Co-ordinator. Mr. Wilson, a graduate of the University of Michigan with a degree in economics, joined Pennsalt in 1941. After service in the Navy, he rejoined Pennsalt in 1946.

DEMUTH CLOSES BROOKLYN PLANT

Following the closing of its Brooklyn, New York, plant and the sale of the building, Demuth Glass Works has announced that all operations are now at Parkersburg, West Virginia.

The Parkersburg plant is operating three continuous tanks with four Danner process machines and a substantial addition has been made by the management to house a fabrication operation producing vials, ampoules and other special items formed from tubing and rod.

The products now being manufactured are lime and borosilicate glass tubing and rod sold in bulk, vials, ampoules, heavy and light wall cylinders, towel bars, oil cups, gauge glasses, fluorescent lamp blanks, crystal and colored cane and tubing for bead, button and novelty manufacturers.

The personnel of the Parkersburg plant is F. W. Britt, President and Treasurer; J. G. Clarke, Vice President in Charge of Special Sales; W. P. Forbes, Eastern Sales Manager; H. E. Todd, Western Sales Manager; H. Julian, Plant Superintendent; and G. Thompson, Plant Engineer.

Demuth will maintain a sales office in New York City located at 11 West 42nd Street, and in charge of B. H. Hedges.

HARTFORD-EMPIRE PURCHASES STANDARD-KNAPP

Announcement has been made of the purchase by Hartford-Empire Company of the outstanding shares of common stock of Standard-Knapp Corporation of Portland, Conn. Standard-Knapp is a manufacturer of automatic units for marking shipping cartons, labeling jars and bottles and packing containers into shipping cartons.

Hartford-Empire, through the purchase, has acquired a modern plant of 70,000 square feet of floor space in Portland, fully equipped with modern machine tools.

Present Standard-Knapp top executives will continue as officers. They are A. E. Rideout, President; George Ingham, Vice President and General Manager; H. H. Mosley, Vice President in Charge of Manufacturing; and Malcolm McFaull, Vice President.

FIBERGLAS TEXTILE DIVISION AND LABORATORY MOVE

Establishment of the Fiberglas Textile Division at New York City and transfer of the Fiberglas Textile Products Development from Newark, Ohio, to the Fiberglas plant at Ashton, Rhode Island, were recently announced by Owens-Corning Fiberglas Corporation.

The purpose of the moves is to centralize sales, service and development of Fiberglas textile at locations convenient to the textile industry. The Textile Division in New York will be staffed largely by personnel now employed in the Fiberglas Yarns Division in the firm's general offices there, as well as others engaged in textile scheduling, production specifications and service activities.

Operations of the Textile Laboratory at the Rhode Island plant are expected to start shortly after the first of the year and work to be carried on there will be mainly in cooperation with weaving mills and cloth processors to develop applications for Fiberglas yarns and fabrics.

INVENTIONS AND INVENTORS . . .

(*Continued from page* 30)

ful but this invention provides a better seal by making the surfaces to be sealed in somewhat the shape of a cone.

One form of the invention is shown in Fig. 4 where the anode 2 of an X-ray tube is illustrated. The anode is enclosed in the glass envelope 5 and a hood 3 has a window 4 for the passage of the X-ray beam. An intermediate sleeve 6 having a coefficient of expansion about like that of the glass envelope 5 is usually provided. In this invention, the stem 7 is provided with a spherical shoulder 8 which is inclined with respect to the axis of the stem. The joint is made by a ring 9, a washer 10 and a layer of solder 11.

With glass of the kind commonly used for X-ray tubes, the intermediate member 6 may be made of an alloy consisting largely of iron, nickel and cobalt with perhaps small amounts of manganese and carbon. Alloys of this type are sold under the trade names of "Kovar" and "Fernico".

The following references are of record in the file of this patent: United States Patents: 2,210,699, Bahls, Aug. 6, 1940; 2,147,418, Bahls, Feb. 14, 1939; 1,880,571, Wellman, Oct. 4, 1932; 2,279,831, Lempert et al., Apr. 14, 1942; and 2,327,586, Altee, Aug. 24, 1943. Foreign Patents: 574,500, Great Britain, Jan. 8, 1946. Other References: *Electronics*, October 1940, page 30. (Copy in Division 54.)

Lamp Bulb Sealing Machine. Fig. 5. Patent No. 2,432,491. This invention was made by Ralph B. Thomas of Beverly, Mass., who assigned it to Hygrade Sylvania Corporation of Salem, Mass. The machine seals the bulb and stem together in good alignment and without depositing foreign matter inside the lamp as might happen when the seal is made by the use of a gas flame.

As shown in Fig. 5, a lamp bulb 1 is held at the top by a support 12 carried by rods 13 and 14, and at the bottom by a clamp 15. The stem 2 rests on a carbon ring 18 supported by a flange 53 of a stem holder 28. A metal piece 39 carries these parts by means of rods 41. A tube 17 depending from the stem holder, protects the exhaust tube 7.

Below this mechanism, is a coil 19 enclosed in a tube 20 and connected with a source of high frequency power indicated at 52. The coil may be copper ribbon and of course must be properly insulated.

The frame 39 is mounted to slide on rods 21 and 22 and it is held in upper position by a latch 23 which engages a collar 24. When the frame is lowered, stops 25 and 26 position the stem holder inside the coil 19. Power is then supplied to the coil 19 which heats the carbon ring 18 to a temperature of perhaps 1100°C. When the frame is lowered, the tube 17 engages a plunger 46 which is held upwardly by a spring 49 in a sleeve 45 mounted in the base 51. As soon as the glass becomes soft, the spring will push the tube 17 up about one-sixteenth of an inch thus pressing the stem 2 and tube 1 into close contact. The time of this movement is determined by the softness of the glass so that the sealing always occurs at the proper time.

After the seal has been made, the frame 39 is lifted to the position shown in the figure. It is necessary for the carbon ring 18 to cool to some extent so that it may

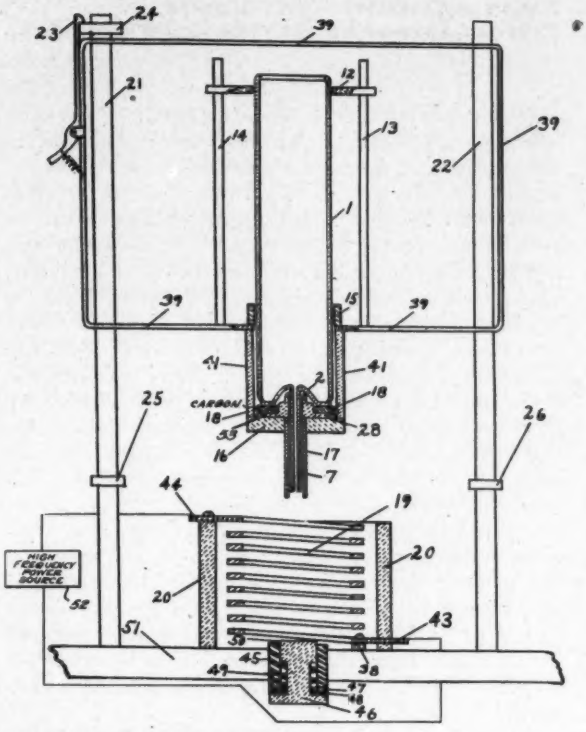

Fig. 5. Lamp Bulb Sealing Machine.

be removed from the lamp to be used again.

The following references are of record in the file of this patent: United States Patents: 1,572,873, Allcutt, Feb. 16, 1926; 1,904,214, Fagan, Apr. 18, 1933; 2,048,556, McArthur, July 21, 1936; 2,121,627, Donovan et al., June 21, 1938; 2,125,316, Ronci, Aug. 2, 1938; 2,203,917, Malloy, June 4, 1940; and 2,272,927, Stager, Feb. 10, 1942. Foreign Patents: 474,947, Germany, Apr. 15, 1929; and 542,173, Germany, Jan. 22, 1932.

HENRY TEICHMANN OPENS PITTSBURGH OFFICES

Henry F. Teichmann, President, Henry F. Teichmann, Inc., has announced the opening of engineering and contracting offices in the Pitt Bank Building, Pittsburgh, Pa.

Officers of the new firm are Henry F. Teichmann, President; Henry J. Koehler, Vice President; and Henry F. Teichmann, Jr., Secretary-Treasurer.

The new firm offers consulting, engineering and contracting services to the glass and ceramic industries.

GLENN MENGLE HEADS BUCKTAIL COUNCIL

Glenn A. Mengle, of Brockway Glass Company, was unanimously elected as the fourth President in its seventeen years of existence of Bucktail Council Boy Scouts of America at the eighteenth annual meeting recently held.

The conference, bringing Scouts, Scouters and guests from all corners of the large three-county area, was attended by more than three hundred persons in a re-dedication to service to boyhood and to the duties of selecting officers for the coming year and of hearing reports of progress since the 1946 Council meeting.

ENGINEERING AIR COMPRESSOR INSTALLATION FOR MAXIMUM EFFICIENCY. . .

(*Continued from page* 27)

following general rules should be observed: 1) Pipe sizes should be large enough so that the pressure drop between the receiver and the point of use will not exceed 10 per cent of the initial pressure. Provision should be made not only for the present air capacity but also for reasonable future growth. 2) Where possible, use a loop system around the plant and within each shop and building. This gives a two-way distribution to the point where the air demand is greatest. 3) Long distribution lines should have liberal size receivers located near the far ends or at the points of occasional heavy use. Many peak demands for compressed air are instantaneous or relatively very short and storage capacity near such points avoids excessive drop. 4) Provide frequent outlets on each header or main for attaching hose for air-operated equipment, always putting the outlet at the top of the pipe line to prevent carryover of condensed moisture to the tool. Frequent outlets result in shorter hose length and, therefore, less pressure drop through the hose. 5) Arrange all piping so that it slopes toward a drop leg or moisture trap in order that condensed moisture may be removed from the piping system and prevent it from being carried over into the air tools or compressed air-operated devices where it is harmful.

In planning the distribution system, it should be remembered that over-size piping costs little more than smaller size because most of the initial expense is for labor.

Type of Compressor: Following the five analyses and thorough consideration of the data obtained, the selection of the particular type of compressor—that is, reciprocating, rotary or centrifugal—should be based on consultation with various manufacturers whose engineers are best qualified to make such recommendations.

Before finally determining the precise type of compressor to be installed, consideration should also be given to the various types of power used to drive compressors —electricity, steam, oil, gas or gasoline. The type of drive deserves careful study from the standpoint of first cost, operating cost, reliability of power or fuel supply and maintenance. Anticipated plant load factor will also occasionally have a bearing on the selection.

The above discussion has been in the general nature of an outline. Manufacturers of compressed air equipment maintain trained staffs qualified to advise on specific problems in the generation and distribution of compressed air power.

Part II of this article will discuss a costly and wasteful practice which should not be tolerated—low air pressure. Causes, effects and remedies of this abuse will be covered.

PART II—Low Air Pressure—Its Causes, Effects and Remedies

Low air pressure is an abuse of the compressed air system—is a costly and wasteful practice which should not be tolerated. Ignorance of the effects of low air pressure contributes more than any other single factor to a lack of appreciation of the effectiveness of compressed air power.

By "low air pressure" is meant inadequate pressure at the tool or the device which is air operated. It is at this point that the air is used as power. Only the pressure and volume of air available at the point of use can be effective in doing work. Most pneumatic tools, for example, are designed to operate at 90 pounds gauge maximum at the tool. This means pressure at the point where the air enters the tool while the tool is operating. If the pressure is below the range of 85 to 90 pounds gauge, then it should be considered too low since it reduces the ability of the tool to do the maximum work for which it was designed.

The Causes of Low Air Pressure. The causes of low air pressure are easily classified: 1) Insufficient compressor capacity, 2) Inadequate piping and 3) Leakage.

When it is discovered that pressure is too low, the first inclination is to install more compressor capacity. That is not necessarily the correct answer. It should first be determined whether the compressors are at full load when the air pressure is low. If they are, then more compressor capacity may be required but, even then, consideration must first be given to two other common causes of low air pressure.

The second cause is "inadequate piping." A measure of the adequacy of piping is the pressure loss between the air receiver, where the compressor endeavors to maintain a constant pressure, and the point of use. This should not exceed 10 per cent in a well designed system. The absolute maximum drop for the worst point in the system should not exceed 15 per cent. If the pressure drop is greater than 10 per cent average, 15 per cent maximum, throughout the entire distribution system (including hose), then attention should be given to correction of this fault before considering increased compressor capacity.

A third cause of low air pressure is leakage or loss of air without doing work. It has been pointed out that permitting excessive leakage is the same as exhausting the output of a compressor directly to atmosphere.

Obviously, if leakage is eliminated, the compressed air formerly wasted will be available for useful work. The expense of making lines tight will undoubtedly be less than the installed cost of a new compressor, while the daily power saving may be considerable.

The gas industry considers a loss of more than one cubic foot per minute per *mile* of 3-inch line as excessive.

Elimination of leakage is certainly a sensible step toward maintaining air pressure and conserving power.

The Effects of Low Air Pressure. There are very few uses of compressed air not vitally influenced by low air pressure. All portable pneumatic tools, rock drills, concrete breakers, hoists, scrapers, loaders, all pneumatic transfer and conveyor systems, paint sprays, oil burners, sandblasts, air lift pumps, etc., operate less effectively when the proper air pressure is not maintained.

The positive result of increasing air pressure to the proper value is: 1) Increased production and 2) Reduced cost per unit produced.

The economic advantages of increased air pressure (or conversely, the losses due to low pressure), can be nicely illustrated by considering portable pneumatic tools. For example, an average increase of 37 per cent in production can be obtained for about 30 per cent increase in air consumption by increasing the air pressure at the tools from 70 to 90 pounds.

Consider an installation of 20 tools operating from an $8500.00 compressor plant, first at 70-pound gauge and then at 90-pound gauge.

With power at 1c per kilowatt hour, fixed charges at 15 per cent of installed cost, plus labor and supplies, air at 100-pound pressure costs 5c per 1000 cubic feet.

The following tabulation brings out pertinent data:

Operating Air Pressure at compressor..	100 lb. ga.	100 lb. ga.
Operating Air Pressure at tools.....	70 lb. ga.	90 lb. ga.
Tool Load Factor.....	33%	33%
CFM required per tool at maximum load	50	68
Number of men and tools.....	20	20
Total CFM used.....	333	453
Total cu. ft. used per 8-hr. day.....	160,000	217,600
Cost of air per 1000 cu. ft.....	$ .05	$ .05
Cost of air per day.....	8.00	10.88
Increased air cost.....	——	2.88
Labor rate per 8-hr. day (incl. burden).	16.00	16.00
Total labor cost per day.....	320.00	320.00
Total cost per day.....	328.00	330.88
Ratio of air cost to total cost.....	2.4%	3.3%

Assuming that only one-third of the 37 per cent increase in tool productivity can be translated into labor productivity, it is evident that 12 per cent more actual work will be accomplished with 90-pound gauge air pressure than with 70-pound gauge air pressure. The work previously done for $328.00 can now be done in less time and will reduce the cost to $330.88 divided by 1.12, or $294.71. Thus, even though air costs are increased, there is a net saving of $33.29 per day, or about $8500.00 per year (equal to the first cost of the compressor plant).

Analyzing this another way, when the pressure is increased to 90-pound gauge, the tools require 120 cubic feet per minute more air. A compressor with motor and auxiliary equipment to supply about this amount of air would cost $2200.00. The saving of $33.29 per day would pay for this new unit in 68 working days, less than three months.

When the question arises of purchasing additional compressor capacity as opposed to making other arrangements for the operations involved in a shop, it should be remembered that adding to compressor plant capacity frequently affords protection for many vital shop operations other than the operation of pneumatic tools. Among these are sandblasting, paint spraying, hoisting, agitation of liquids, air jet vacuum equipment for cleaning foundry sand, operating controls in power plants, air chucks in a machine shop, safety devices on punch presses, air jets for ejecting parts from presses, etc.

The Remedies for Low Air Pressure. The remedies for low air pressure are just as definite as the causes and effects.

Faulty air power conditions are usually due to poor planning or to increased air uses without corresponding system expansion. Plant-wide analysis should determine the full extent of low air pressure and the present air flow requirements. Future growth must also be considered.

Pressure loss varies roughly as the square of the velocity of air flowing through the pipe. For example, a 3-inch line, 1000 feet long, will handle 500 cubic feet per minute with a 2.5-pound pressure loss, while a 4-inch line will pass about 1000 cubic feet per minute with the same drop. The *installed* cost of the 4-inch line will, however, be very little more than that of the 3-inch line, since most of the cost is labor.

Methods of increasing pipe line capacity to decrease pressure loss and improve conditions at the point of use vary with different installations. One may call for a line paralleling the original, with frequent interconnections; another may require installation of a loop system with some outlets taken off the new line to relieve the old; still another may need a complete new system.

Branch lines and manifolds for attachment of tools, etc., should be planned "oversize."

Not the least of the problems of correct system layout is the selection of proper hose for final transmission of compressed air to the tool. Losses of 15 per cent to 25 per cent in air pressure are frequent in the hose alone. *Don't* use a hose longer than is necessary to make the tool available to the work and to give proper freedom of movement to the operator.

Every cubic foot of leakage eliminated is pure gain. Such losses in many systems will reach 10 per cent to 20 per cent of the total air compressed. An air leakage test should be run on the complete plant and every section of hose should be inspected. Although leaks are usually small, they may be numerous, having a high total effect. A single 1/16-inch hole will waste 182,000 cubic feet per month, costing $9.10.

The most likely locations of small leaks is around valve stems, in hose connections, unions, drains, home-made blow guns, and lines leading to inoperative tools.

Elimination of leakage involves making the system tight, then KEEPING IT TIGHT. Regular inspection is mandatory.

Only after it has been determined that the distribution system is adequate and that leakage has been eliminated, should increase in compressor capacity be considered.

CHICAGO TECHNICAL AND SCIENTIFIC CENTER CREATED

Creation of a Chicago technical and scientific center through an alliance between the Western Society of Engineers and the John Crerar Library was formalized recently with the signing of an agreement between the two organizations.

The agreement covers the leasing by the Western Society of space in the Taylor Building and the establishment by the engineering group of a science and technical center for the use of professional persons, students and others interested in the advancement of science.

The library of the Western Society, a collection of more than 20,000 books and pamphlets, will be coordinated with the 700,000 volume Crerar Library, the world's largest free public library devoted exclusively to science and technology.

PLASKON RESEARCH DIRECTOR NAMED

Dr. William C. Dearing has been named Director of Research of Plaskon Division of Libbey-Owens-Ford Glass Company, it has recently been announced.

Dr. Dearing has degrees from Oakland City College, Princeton University and Western Reserve University. He joined Plaskon in 1937 to initiate the research and development program on synthetic resin adhesives and industry resins. In 1945, he was made Associate Director of Research for Plaskon Division covering the general fields of molding materials, industrial resins, adhesives and coating resins.

GLASS TANK FURNACES

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The constant demand for this useful and informative book has necessitated another printing.

Glass Tank Furnaces is the only book in the English language dealing comprehensively with glass tanks. Its contents include and describe in simple language, the most modern practices in design, construction, operation, behavior and economy of glass tanks. It is a book for the factory man, the technologist and for all who are interested in the practical aspects of glass making.

Glass Tank Furnaces contains 105 figures and illustrations—75,000 words typed in two columns and produced by the lithoprint process. Cloth bound, price $4.00. Foreign $4.50, F.O.B.

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CULLEN WARNER PARMALEE . . .

(*Continued from page* 24)

As one of the pioneers in ceramic education, as a teacher and administrator and in the field of research Professor Parmelee made outstanding contributions in his more than forty years of active service in the ceramic field. His technical and scientific investigations were widely known and quoted. His aid to ceramic industry through his activities with manufacturers' organizations was equally appreciated. As Head of the Department of Ceramic Engineering he promoted and expanded graduate instruction and research. Under his direction, investigations in glass brought international recognition to the University of Illinois in this field. The evaluation and appreciation of his work is well expressed in the inscription on a ceramic plaque erected by the alumni of the Department in the corridor of the Ceramics Building following his retirement in 1942.

> "Cullen Warner Parmelee
> In appreciation of his contribution to ceramic engineering education and to the technology of the ceramic industry."

Be it Resolved that this be adopted by the Senate as an expression of its appreciation of the long and valued service of Cullen Warner Parmelee, that it be incorporated in the Minutes, and that a copy be sent to Mrs. Parmelee.

GEORGE B. FLETCHER DIES

Announcement has been made of the death of George B. Fletcher. Mr. Fletcher was the Chicago representative for the Cambridge Wire Cloth Company and had been associated with that company for many years.

LACLEDE-CHRISTY APPOINTMENTS

Arthur B. Morse has recently been named a Vice President and Assistant Director of Sales of the Laclede-Christy Clay Products Company.

A graduate of the University of Southern California, Mr. Morse has had more than twenty years' refractory experience with prominent West Coast concerns. He began his career with the Dee Engineering Company, later moving to the Vitrefrax Corporation. For the next 14 years, Mr. Morse was associated with the Stockton Fire Brick Company and with its successor, Gladding, McBean and Company, for the four years prior to joining Laclede-Christy.

The appointment of John B. Ives as Vice President in Charge of Production was also announced. Mr. Ives' new promotion follows a career spent entirely with the Laclede-Christy company.

Graduating with a B.S. Degree in Ceramic Engineering from Iowa State College in 1926, he joined the company's Christy plant, where he was made Head of the Industrial Engineering Department in 1929. From 1931 to 1941, Mr. Ives was Superintendent of Laclede-Christy's Buckeye Plant at Toledo. In 1941, he was named Assistant Vice President in Charge of Production at St. Louis, and became General Superintendent in 1942. He was appointed Manager of Operations early in 1947.

A.C.S. FIFTIETH ANNUAL MEETING ANNOUNCED

The American Ceramic Society will hold a Golden Jubilee Exhibit in conjunction with its Fiftieth Annual Meeting at Chicago, in the Palmer House, April 25-30, 1948.

The Society has appointed Ken M. Davee, 11 South LaSalle Street, Chicago 3, Illinois, as Exhibit Manager in Chicago.

A partial list of companies having displays at the exhibit are: Amsler-Morton Company, Atlantic Sponge & Chamois Corp., Avery Adhesive Label Company, The Bonnot Company, Corhart Refractories Co., Deister Concentrator Company, Denison Engineering Company, De Vilbiss Company, B. F. Drakenfeld & Co., Electro-Refractories & Alloys Corp., Eriez Manufacturing Company, Fate-Root-Heath Company, Ferro Enamel Corporation, S. G. Frantz Co., Inc., Great Lakes Foundry Sand Co., Hardinge Company, Inc., The O. Hommel Company, Ingram-Richardson Manufacturing Company of Indiana, International Clay Machinery Co., Kux Machine Company, Lancaster Iron Works, Magnaflux Corporation, Magni-Power Company, Paul McKamy & Associates, Metalloy Corporation, National Engineering Company, New Castle Refractories Company, Orefraction, Incorporated, Patterson Foundry & Machine Co., Pemco Corporation, Perma Flex Mold Company, Polarizing Instrument Company, Robinson Ventilating Company, Rotospray Manufacturing Co., Sauereisen Cements Company, H. C. Spinks Clay Company, F. J. Stokes Machine Co., Swindell-Dressler Corporation, Titanium Alloy Mfg. Co., U. S. Gypsum Company and Universal Sanitary Mfg. Co.

CANADIAN IMPORT REPORT

Canada's imports of glass declined in September this year compared with a year ago in the same monthly period, dropping from $2,201,000 in September last year to $2,016,000 in September this year, according to the External Trade Branch of the Department of Trade and Commerce.

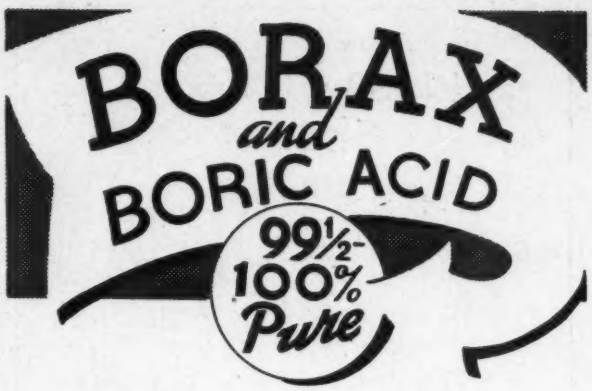
However, such imports into the Canadian market have been running ahead so far during 1947 for the first nine months ended September since these have totalled $22,037,000 as against $15,968,000 for the same period in 1946.

This official report also emphasizes the fact that Canadian imports of glass have been moving at a much higher value so far in this postwar year because, in sharp contrast to the above imports, in the last complete peacetime year prior to the war, these imports had amounted to $570,000 only in September of 1938 and merely $4,718,000 for the first nine months of that year, reflecting the present trend.

HARBISON-WALKER NAMES BRANCH SALES MANAGER

The appointment of E. M. Sarraf as Cleveland District Sales Manager of Harbison-Walker Refractories Company has been announced by that company.

Mr. Sarraf has been Assistant District Sales Manager in the Cleveland territory for the past year. He joined the company at its laboratories in 1926, but later devoted his time to the Technical Department until 1935 when he entered sales in the company's Cleveland offices.



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German troops crossed the Czechoslovak frontier in the first step of the occupation of the Sudetenland.

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EXAMINING MIRRORS FOR TELEVISION

The quality of a concave spherical mirror, which is one of the components of a projection television system, is being examined at Philips Laboratories, Inc., Irvington, New York.

The instrument shown utilizes a concentrated arc lamp as a point light source and provides a means for projecting a wide angle beam which is capable of covering any mirror up to 14" or more in diameter.

By this method, mirrors of commercial quality are tested and evaluated in terms of their performance characteristics. The quality of the image formed by the mirror is examined through the same lens system by which the beam is projected.

Precision adjustments are provided for transverse, longitudinal and vertical movement of essential parts of the apparatus. Through laboratory development of such instruments and techniques, the performance of the television sets of tomorrow will be materially improved.

COMMERCE DEPARTMENT ISSUES CIRCULAR ON INVENTORS COUNCIL

A circular outlining the organization and functions of the National Inventors Council, comprised of 16 nationally known scientists, inventors and industrialists, has recently been released by the Office of Technical Services, Department of Commerce. Dr. Charles F. Kettering, retired Vice President in charge of Research of General Motors Corporation, is Chairman of the Council.

The circular describes the Council as a "clearing house for inventions and ideas which will assist the Army, Navy and other public agencies in solving technical problems affecting the national defense and welfare."

Copies of the circular and summary statements of technical problems confronting the Army and Navy are available from the Council upon request. Communications should be addressed to National Inventors Council, Department of Commerce, Washington 25, D. C.

GAMES SLAYTER TO RECEIVE RESEARCH INSTITUTE MEDAL

Games Slayter, Vice President in charge of Research and Development of Owens-Corning Fiberglas Corporation, has been chosen to receive the 1948 Industrial Research Institute medal presented for outstanding contribution to the field of industrial research.

The Institute, composed of ninety-three companies representing diversified types of industry throughout the nation, cited Mr. Slayter for his leadership in the development of glass fibers and their commercial application. The medal will be presented February 5 during the winter meeting of the Institute at Rye, New York.

AMERICAN GLASS DISPLAYED AT TOLEDO MUSEUM

Since glass has been so closely connected with American and Ohio history, The Toledo Museum of Art, Toledo, Ohio, has arranged a historical exhibit of American glass. The exhibit opened with a lecture by George McKearin, noted authority on American glass. The exhibit and lecture are being sponsored jointly by the Art Museum and the newly established School of Glass Technology of the University of Toledo as the first of a series of programs celebrating its 75th Anniversary.

The glass displayed, selected from the collections of Mr. McKearin and the Museum, will be arranged in proper historical sequence to make it intelligible to the layman, as well as to the collector.

CANADIAN CONSERVATION ORDERS AMENDED

A number of amendments to the emergency exchange conservation orders aiming to save American dollars have been disclosed by the Canadian government and these indicate that glass tableware and cut glassware (Tariff Item 326ii) have been transferred from the prohibited list to category four of the quota list.

"As we gain in administrative experience, it may be possible to develop further quota categories in order to meet the special problems of some of our importers and some of our supplying countries," said a spokesman for the Canadian government. "There are, however, narrow limits to such further flexibility, at least until our basic dollar position has substantially improved."

• American Potash & Chemical Corporation has moved its office at 609 South Grand Avenue to its new executive headquarters building at Sixth Street and Westmoreland Avenue, Los Angeles, California.

CLASSIFIED ADVERTISEMENTS

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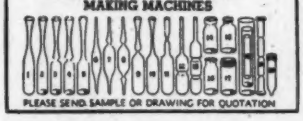
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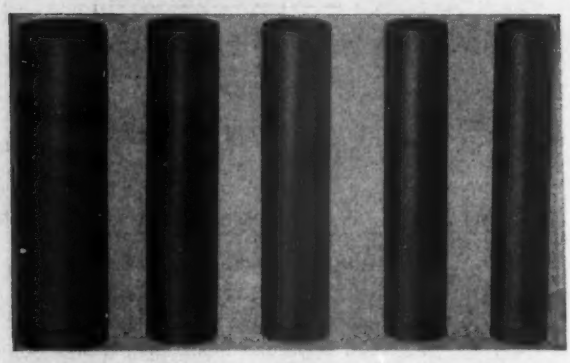

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CHAS. TAYLOR APPOINTS R. W. BOOZE AS REPRESENTATIVE

R. W. Booze has been appointed field representative of The Chas. Taylor Sons Company in the Chicago district.

Mr. Booze, a graduate of the University of Pennsylvania, spent two years in the general sales department at Cincinnati, following his discharge from the Air Corps, U. S. Army, in 1945. He will make his headquarters at 333 North Michigan Avenue, Chicago, Illinois.

HARBISON-WALKER SHORTENS PRODUCT NAME

Harbison-Walker Refractories Company has announced the shortening of the name of its basic refractory brick "H-W Improved Metalkase" to "Metalkase." The company emphasizes the fact that there is no change in quality of the product, which is a steel jacketed basic refractory brick for basic open hearth and electric steel furnaces. Metalkase bricks are produced exclusively by Harbison-Walker.

RICHARD P. BROWN MADE FELLOW OF A.S.M.E.

Richard P. Brown, Chairman of the Board of Brown Instrument Company, has been made a Fellow of the American Society of Mechanical Engineers.

Mr. Brown, a Director of Minneapolis-Honeywell Regulator Company, holds 54 patents on industrial recording and control instruments. He was also recently awarded an honorary degree of doctor of engineering by Drexel Institute of Technology.

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